THE FOUNDRY

for September

Convention Shows Progress

GREAT problems confront all industry. New products take toll from established business. Such problems confront the foundry industry. It needs organization, leadership and followers. These problems cannot be met without organization, without confidence.

At the Toronto convention some of the technical problems of the foundry industry met with real consideration. Papers, discussion, action on these matters are reported in this issue. On every hand at Toronto and in daily correspondence the question, expressed or in the background, is that of effective co-operation. The foundry industry has leaders and some of them were in Toronto. It has followers and many were there.

Suggestions are made that the American Foundrymen's association should undertake for its members broader industry actions vital to all branches. These embrace leadership and direction in activities covering the following:

1—Technical.
2—Educational.
3—Sales promotion.
4—Industrial Health.

Technical activities, always a function of the A.F.A. through conventions, papers, committee work can be broadened and made effective through schools, engineering societies and local chapter work.

Educational work can be intensified through organized instruction of apprentices, foremen and superintendents.

Sales promotion can be furthered. The *Cast Metals Handbook*, first shown at Toronto, is a step. Contact with government, engineering societies, railway and industrial users to present the merits of castings is imperative. Promoting fair castings specifications, resisting untrue disparagement, spreading the knowledge of new foundry products and uses can promote sales.

Industrial health hazards challenge the foundry industry. Constructive action is needed to find the facts of the silicosis problem and to solve it. The racket phase is past. Hysteria is evaporating and silicosis may be discussed without inciting predatory attacks from shyster lawyers. Foundry work is not a mankiller. But much work can be done to improve working conditions, to provide for health and safety, to meet real compensation needs. The job is constructive, not defensive.

If we have confidence in the future of our industry we should step forward to make co-operation through the American Foundrymen's association and all worthy agencies a potent factor in pulling foundries out of the depression.

What do YOU think?

Just Supposing—

AN ENGLISH publication, *Manchester Guardian*, offers prizes for an advertisement appealing for new citizens. It says: "Supposing a world-wide plague suddenly reduced the population of every country, and each government might be forced to advertise for citizens. Write advertisements to be issued by the governments of any two nations appealing for such new citizens."

Shortage of men might suggest something of the same nature in the foundry industry. What would be the ideal foundry apprentice, molder, foreman, superintendent? What specifications would describe the best manager? What are the characteristics of leaders so vitally needed in the foundry industry? Write your specifications for such ideals on your job. Then grade yourself on your own rating.

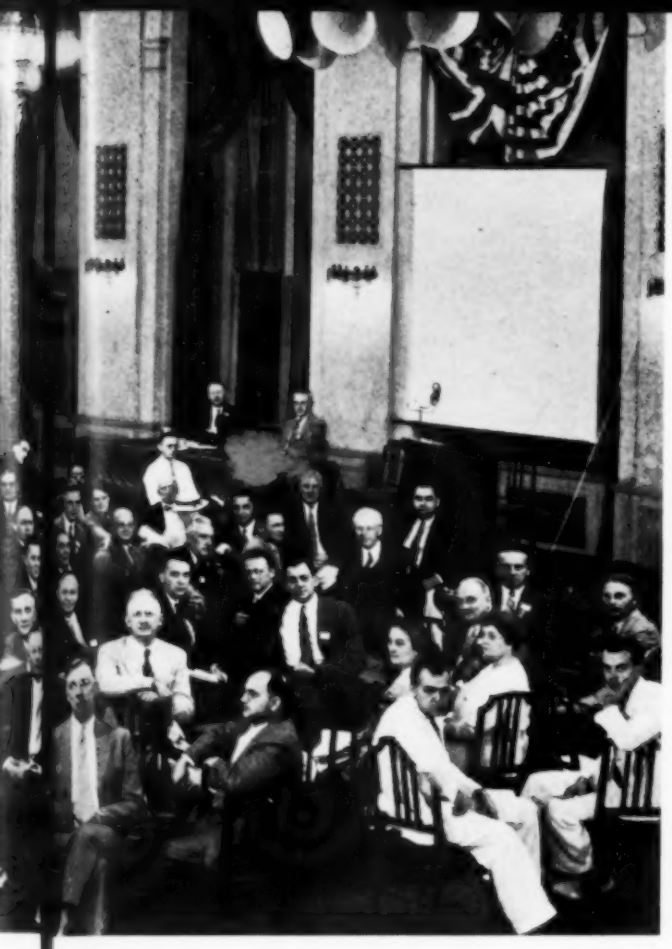
Editor

Canadians Entertain as A. F. A. Gathers To Review Foundry Progress

CANADIAN hospitality, so exceptionally exemplified by the foundrymen of the Toronto district, provided a happy back ground for the 1935 Toronto convention of the American Foundrymen's association where committee meetings, regular sessions, round table discussions and shop courses were devoted to the technical and business phases of the industry. Details for the entertainment of convention guests were well arranged by the men and women of the local committees. The ladies of the convention, of which there was a larger number than usual, all reported exceptional pleasure at the afternoon teas held at the Royal Canadian Yacht club and Granite club. The men appreciated greatly the arrangements which had been made for visiting plants in the district, and many attending the convention took advantage of the opportunities offered to inspect Canadian practices. Both the ladies and men enjoyed the entertainment at the annual dinner on Thursday evening and many attended the reception and dance which followed.

Attendance at the convention in the Royal York hotel during the week of Aug. 19 was approximately 1000, a highly satisfactory total for a purely technical meeting. With practically all convention activities centered on the convention floor of the hotel, a splendid opportunity was presented for renewing acquaintanceships and exchanging experiences. Attendance at most meetings was remarkable, and especially at the session on Wednesday evening which was taken up with a discussion of industrial health hazards and employer responsibility.

Sentiment among foundrymen present at the Toronto meeting concerning the general business situation in the industry was the best in years, even exceeding greatly the enthusiasm displayed at Philadelphia a year ago when the industry definitely recognized a recovery from the years of depression. Conversation with convention visitors revealed that many plants now are working at the best rate in quite some time, and prospects for the fall and winter appear good. Numerous instances were reported



Attendance at the various meetings was remarkable. The illustration at the left shows the crowd at the session on Industrial Health Hazards and Employer Responsibility held Wednesday night

where the rush of business prevented men from attending the convention. With many manufacturers of foundry equipment and supplies reporting a higher sales total thus far this year than in all of 1934, and with some now making favorable comparisons with some of the pre-depression years, sentiment among those groups is excellent.

The new schedule of convention activity tried this year for the first time on the first and second days of the convention, met with general approval. On those days the first technical session was held from 9 to 11 in the morning, and the second from 11 a.m. to 1 p.m. The afternoons were free for plant visitation and recreation, with both parts of the afternoon program acquiring many adherents. Increased activity on a number of Toronto golf courses was evidenced on both afternoons. The serious business of the convention was renewed in the evening, with one technical session and two shop courses. These meetings were well attended with many local foundrymen indulging in the evening shop courses.

The thirty-ninth annual convention of the American Foundrymen's association was opened officially on Tuesday morning, by President Dan M. Avey, editor of THE FOUNDRY, Cleveland. Attendance at this meeting was one of the largest in recent years. The president introduced Maj. L. L. Anthes, Anthes Foundry Ltd., Toronto, a past president of the association and chairman of the Toronto Foundrymen's committee, who welcomed the members and guests on behalf of the foundrymen of the Toronto district. Major Anthes paid fitting tribute to the unity which exists between the people of Canada and the United States.

C. E. Hoyt, executive secretary of the association, reported briefly on some of the important activities of the association. He stated that during the past year the total membership of the organization has increased, indicating a definite recovery from the depression years. He also called attention to the development of the chapter activities as a definite contribution to the further dissemination of foundry knowledge.

Mr. Hoyt stated that in addition to the four chapters now organized and functioning, four more probably will be formed in the near future. The secretary also spoke of the close alliance which exists between the A.F.A. and other technical societies, especially the A.S.T.M. in the work of preparing specifications for castings, and the A.S.M.E. in holding joint meetings for promoting the use of castings. Mr. Hoyt also announced the recent publication of the *Cast Metals Handbook* by the association.

Societies Exchange Fraternal Greetings

Announcements concerning various features of the technical program were made by Robert E. Kennedy, technical secretary. Frank G. Steinebach, THE FOUNDRY, Cleveland, and chairman of the international relations committee of the A.F.A., read messages of greetings and best wishes for a successful convention from the Institute of British Foundrymen and the Association Technique de Fonderie of France. A motion was passed unanimously instructing the chairman to respond to the messages.

In the presidential address, Mr. Avey discussed a number of problems which now face the foundry industry. He pointed to the general inadequacy in plant and equipment due chiefly to obsolescense and the financial stringency of the past years. In contrast, technical accomplishments have moved ahead steadily during the past six years. Nevertheless, the industry cannot afford to become complacent in its attitude toward technical advancement, but must continue to forge ahead to broaden its markets and meet the competition of other industries. In this, the A.F.A. offers facilities under its present structure for organizing individual projects to the benefit of groups or classes of cast products.

President Avey discussed in some detail the lack of trained men in the foundry industry and

pointed to the possibilities for united action through the association. He mentioned the school recently established in Birmingham, England, through the efforts of the Institute of British Foundrymen and other interested organizations and stated that perhaps such a plan might be established in the United States. The problem of silicosis and the need for tackling the problem constructively and effectively through the A.F.A. was stressed. Upon a motion of William Grede, Liberty Foundry Co., Wauwatosa, Wis., a committee was appointed to study the problem and present a policy for organization.

Hold Annual Business Meeting

Dan M. Avey, editor, THE FOUNDRY, Cleveland, was re-elected president of the association at the annual business meeting held Thursday afternoon. B. H. Johnson, assistant to the president, R. D. Wood Co., Philadelphia, was re-elected vice president. Mr. Johnson's sudden death at Toronto on Aug. 27 has shocked greatly the entire foundry industry.

The following directors were elected for a term of three years: Henry S. Washburn, president, Plainville Casting Co., Plainville, Conn.; Lamar S. Peregoy, president, Sivyer Steel Casting Co., Milwaukee; C. E. Davis, Alloy Specialty Co., Coraopolis, Pa.; W. H. J. Cluff, Frederic B. Stevens Inc., Detroit; Frank A. Sherman, vice president, Dominion Foundries & Steel Ltd., Hamilton, Ont.

A committee appointed by President Avey at the opening meeting and consisting of Karl Dodge, Link-Belt Co., Philadelphia; Fred J. Walls, International Nickel Co., Detroit; and James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind., reported the following nominating committee for the selection of nominees for officers and directors to be presented at the 1936 convention: A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; A. Walsher, American Steel Foundries, Chicago; H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland; and G. H. Clamer, Ajax Metal Co., Philadelphia.

A report of the committee was accepted and these members declared elected to the nominating committee. According to the by-laws the last three past presidents also will serve on the nominating committee.

A feature of the annual dinner held Thursday evening in the ball room of the Royal York was the presentation of the John A. Penton gold medal to Lawrence Lee Anthes, Anthes Foundry Ltd., Toronto, and chairman of the Toronto entertainment committee. Presentation was made by past president Frank J. Lanahan, chairman of the board of awards. The address of the evening was presented by B. K. Sandwell, managing editor of *Saturday Night*. The dinner was followed by a reception and dance provided by the Toronto entertainment committee.

Health Hazards in the Foundry

Numerous problems pertaining to industrial health hazards and employer responsibility were discussed before an enthusiastic audience of over 300 men on Wednesday evening, with President Dan M. Avey presiding. Both the medical and engineering phases of the subject were given considerable attention.

Dr. William J. McConnell, assistant medical director and director of the industrial health section, Metropolitan Life Insurance Co., New York, presenting the first paper, stated that the maintenance of the health of workmen is a practical necessity from an economic standpoint alone. Proper control of the hazards will reduce the cost of the work to an insignificant expense.

The speaker stressed the fact that the essential basis of health control in industry is the physical examination of workers. Selection of workers must be based on a thorough physical examination by competent authorities, and

The attractions of Canada brought many ladies to the convention. The illustration at the left shows the ladies gathered at the Royal Canadian Yacht club on Tuesday afternoon for tea

periodic examinations must be provided as a constant check on the physical condition. Since, unfortunately the average physician is not prepared through experience to interpret properly conditions revealed through these examinations, Dr. McConnell believes that the best plan for industry to follow is the establishment of central organizations equipped to make the necessary physical examinations and capable of conducting physical surveys in the plant.

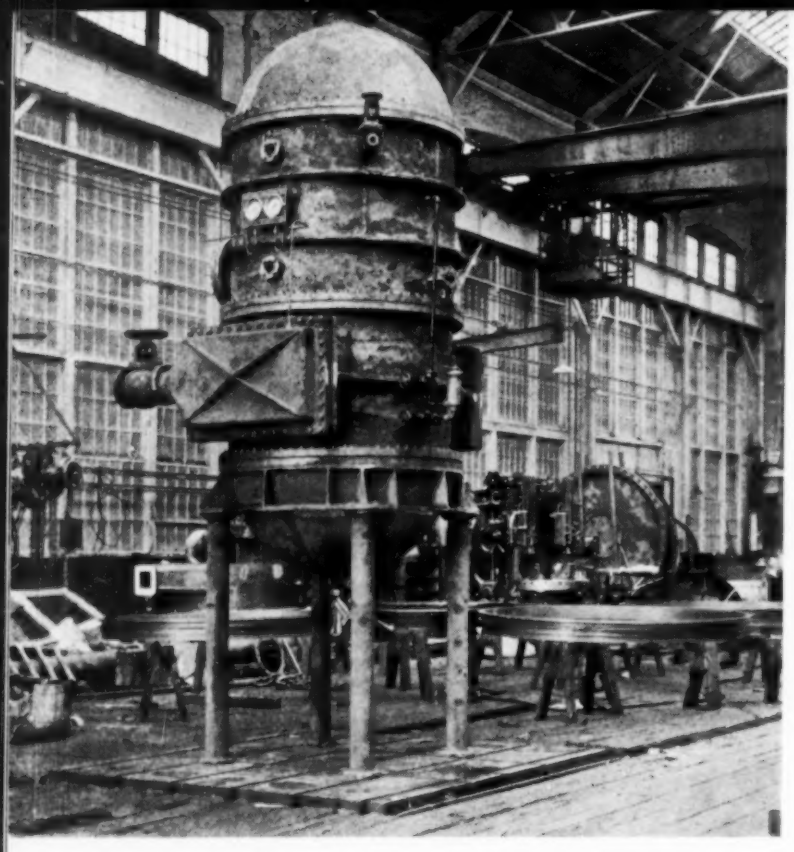
Dr. McConnell stated that in his opinion the industrial dust hazard can be controlled through the proper maintenance of equipment available to the industry. In this connection he outlined many of the things which have been done to prevent production of dust, such as the use of a nonsilica parting, local exhaust ventilation, vacuum cleaning, application of water sprays, moving castings on conveyors to isolated points for shakeout, confining shakeout operations to the night shift, selection of cleaning mediums, and good housekeeping including the removal of unnecessary equipment from the shop.

Donald L. Cummings, assistant director, Saranac Laboratories, Saranac Lake, N. Y., presented an interesting paper dealing with the medical phases of silicosis. Mr. Cummings stated that although a foundry must always be considered a dusty industry, the nature of its operations are such as to induce for the most part only a modified silicosis. Both mortality studies and clinical examinations of foundry workers fail to disclose the type of hazard associated with pure silica exposure. Many men in advance age groups, who have spent their entire lives working in the foundry industry are still capable workmen, suffering from no occupational disability, although most of them will be found to have some degree of pulmonary fibrosis.

According to Mr. Cummings, workmen who are disabled by an occupational fibrosis contracted in the foundry generally are those who exhibit evidence of concurrent pulmonary infection or other injury. Information gathered from field studies made in many parts of the world indicate that a normal man may work for many years in air containing pure crystalline silica dust without impairing his health, providing the concentration does not exceed five million particles per cubic foot of air, as determined by a standard method used in the United States.

Managements' responsibility to employes, according to Mr. Cummings, consists in inaugurating a thorough survey of the plant to determine the existance, nature and extent of the dust hazard. A survey of that type includes the physical and x-ray examinations of the employes, taking occupa- (*Please turn to page* 56)

Manufacturers of foundry equipment held a dinner meeting in Toronto during convention week. A report of the F.E.M.A. meeting is presented on page 50 of this issue



The various castings for the evaporator unit shown assembled in the machine shop. The base casting is iron

« First Prize Contest Story »

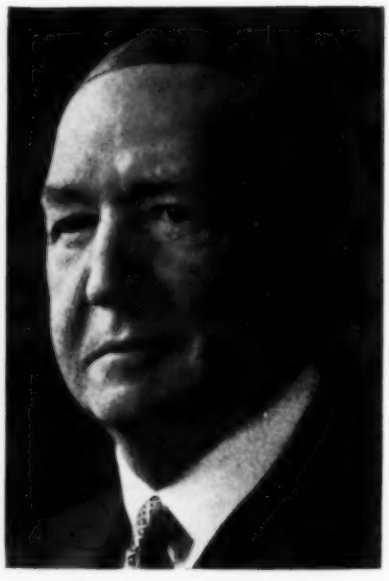
Producing a Large Lead Casting

By F. J. McGRAIL

ABOUT one year ago we received an inquiry which to say the least was unusual. The prospective customer asked us to submit a bid on the necessary lead castings for an evaporator unit shown in the illustration reproduced above and weighing approximately 35,000 pounds. Many years ago in making a number of intricate cored lead castings for a chemical company the heaviest of which weighed approximately 1200 pounds, we learned that the methods differed to a considerable extent from gray iron practice, not only in coremaking and molding, but also in removing the lead castings from the sand.

In that instance the first lead casting was a large valve, molded in green sand, with oil sand cores for the inside. The valve was cast on end, and it stretched nearly ½-inch in lifting it by the top flange from the mold without taking the precaution of loosening the sand around it.

Considerable trouble also was experienced in the machine shop. Several of the lead castings would not retain their shape when they were bolted to the face plate of the lathe with one end unsupported. Knowing that antimony would make the lead castings stronger, that it alloys readily with lead and would not affect the acid-resisting qualities of the apparatus, we recommended its use. We were permitted to use antimony in the mixture and did not experience any further trouble with the castings as far as the metal was concerned, but we did encounter plenty of trouble in coremaking and molding which will be referred to later.



F. J. McGrail

In the present instance two of the lead castings would weigh in the rough more than 8000 pounds each, and with the gates and feeding heads would require about 10,000 pounds to pour. We were somewhat skeptical about tendering a bid due to our former experience with lead castings. Although lead is a tough, malleable, and ductile metal, it has a low tensile strength and contracts considerably upon solidifying , it is much better suited as an alloy and is not well adapted for making large commercial castings.

Judging by our former experience we believed that if we were permitted to add 8 per cent antimony to the lead that the castings would be hard and strong enough to eliminate the danger of breaking or distorting in cleaning, assembling, or in transit to where they were to be used. We submitted this proposal and as our price for making the castings was satisfactory the contract was awarded on that basis.

Including the weight of castings, feeding heads, and pouring gates, we estimated that approximately 35,000 pounds of metal would be required for the evaporator. A contract was made with a smelting and refining company to furnish the metal according to the formula 92 per cent lead, and 8 per cent antimony, made up in pig form weighing about 100 pounds each. All the castings

shown in the assembled view of the evaporator at the lead of this article, except the base ring, and the four suporting columns, were made of antimonial lead, molded in dry sand. Dry sand cores were used throughout.

Description of the lead castings shown in the accompanying illustrations does not present any remarkable metallurgical problem or any radical ideas of advance practice in the art of molding or coremaking. However producing castings of the types shown, frequently present a wide range of difficulties on account of the numerous and varied phases in core, mold, and metal. They can be overcome easily as they do not demand more than ordinary study.

Gated on the Top Flange

While the methods used in making the castings may be disputable, we hope the illustrations are clear enough to explain the subject intelligently, and that they may enable any foundryman to apply the principles to any job of a similar nature.

The plan of the top head of the evaporator, illustrated in Fig. 1, shows the arrangement of the four pouring gates, 1 x 4 inches, at *A*, *B*, *C* and *D*. The four feeding heads, each 4 inches in diameter are shown at *E*, *F*, *G* and *H*. The flow-off riser 1 x 4 inches to check the flow of metal when the mold is filled is shown at *I* in the plan view of the casting. Fig. 2 shows the cross-sectional view of the top head.

We have made gray iron castings similar in shape to the top head shown in Figs. 1 and 2 with a skeleton pattern that had a supporting flange around the top with ribs extending to the bottom of the pattern. We do not approve of that method. The additional expense of pattern-making is not warranted. We prefer to make the mold with a sweep for the inside and another for the outside. We would prefer to make the castings in loam molds but we did not have bricks, lifting plates or cross.

With the exception of the arbor shown in Fig. 5 we had all of the equipment needed to make top and bottom heads in dry sand molds. In making the mold for the top head Fig. 3, a pit 8 feet square was dug in the foundry floor to a

The Contest Winners

AFTER a careful study of the many interesting articles entered in THE FOUNDRY Prize Contest, the editors are pleased to announce the following winners. All of the contributions listed below will be published in succeeding issues.

FIRST PRIZE—$100.00

F. J. McGrail
Foundry Superintendent
Struthers-Wells-Titusville Corp., Titusville, Pa.
"Producing a Large Lead Casting"

SECOND PRIZE—$50.00

Kenneth H. Priestley
Metallurgist
Eaton-Erb Foundry Co., Vassar, Mich.
"Dry Polishing Cast Iron, Steel and Nonferrous Alloys for Microscopic Examination"

THIRD PRIZE—$25.00

Henry P. Biegel
Foundry Superintendent
Allis-Chalmers Mfg. Co. Milwaukee
"The Quality of Iron"

HONORABLE MENTION

T. H. Beaulac
Chicago Pneumatic Tool Co., Franklin, Pa.

Cyril Brecknock
Lorain Castings Co., Lorain, O.

A. J. Cassista
Textile Machine Works, Reading Pa.

R. Cheney,
Johnston & Jennings Co., Cleveland

G. O. Ekstedt,
Ekstedt Foundry Co., East St. Louis, Ill.

Edward Grant
Kansas State College of Agriculture and Applied Science, Manhattan, Kan.

H. W. Kelly
Chicago

J. A. Lanigan
Cincinnati

Jas. A. Murphy
Jas A. Murphy & Co., Hamilton, O.

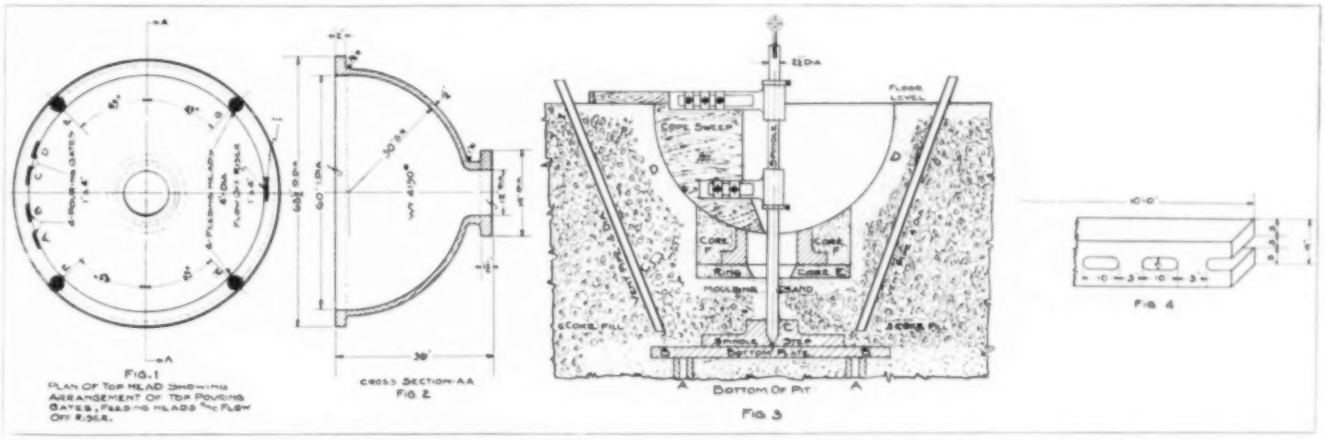


Fig. 1—Plan of top head showing arrangement of top pouring gates, feeding head and flow-off riser. Fig. 2—Cross section of head at A.A. Fig. 3—Sectional view of mold in the floor showing construction details. Fig. 4—Detail of binder

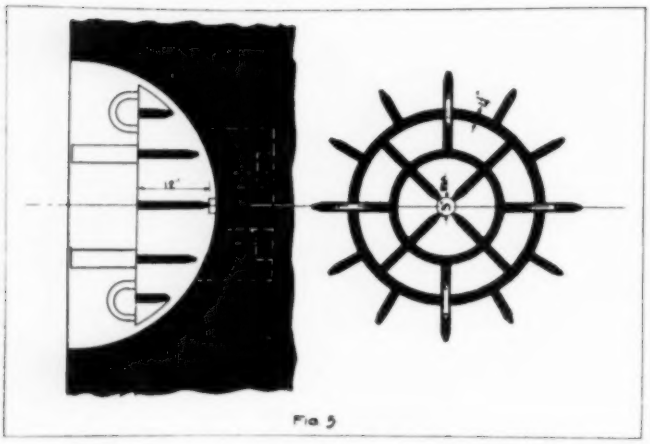


Fig. 5—Inside part of the mold was formed around a cast iron spider

depth of about 5 feet. Two heavy binders shown at *A* in Fig. 3, and in detail in Fig. 4, were spaced equally in the pit and sand rammed to the top of the binders.

A heavy cast iron plate *B*, 2 inches thick, was placed on top of the binders. The step for the spindle was set on top of the bottom plate in the center of the pit as shown at *C*. When the spindle was plumbed in position a heavy coke bed was put in the pit on top of the bottom plate and shaped up around the sides of the pit to about 6 inches from the floor level and about 5 inches from the line of the casting.

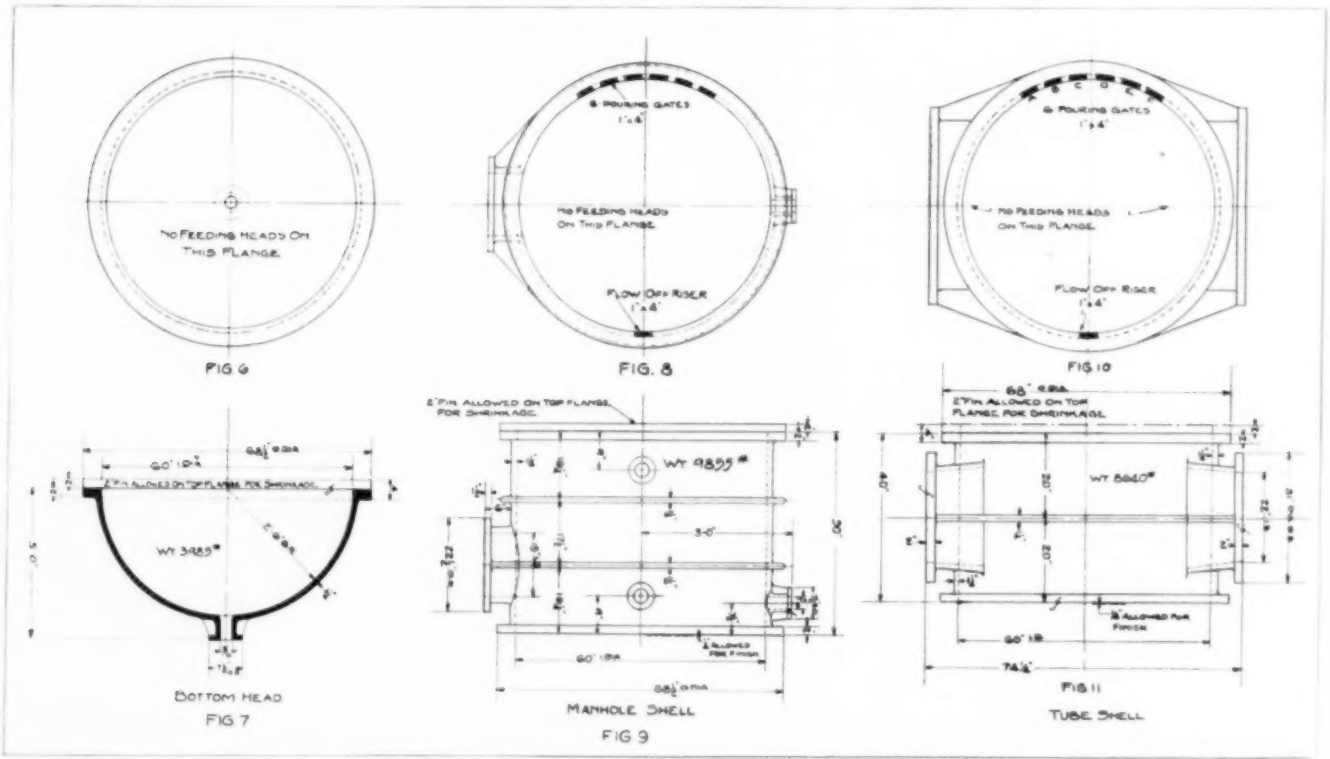
The sweep was revolved on the spindle as a guide in forming the shape of the coke following the contour of the casting, as shown by the line of coke at *D*. The reason for being particular about using so much coke and shaping it up in such a manner was so the outside of the mold would yield easily when the mold was filled with metal and permit expansion.

Vent pipes 4 inches in diameter, one on each side of the pit were connected with the coke bed and the molding operations were started. The spindle being in place a level bed the proper depth from the floor line was swept and the ring core *E* with the tapered opening set in place. The core *F* that forms the flange on the bottom of the nozzle, made in halves and pasted, was set on the ring core *E*, and centered from the spindle. A piece of sheet metal with a hole in the center for the spindle to pass through, bent to fit the upper face of the flange core *F*, was placed over the opening in the center of the core to prevent sand from entering while the inside of the mold was being formed with the sweep.

Arbor Rested on Wood Blocks

Before setting the cope sweep on the spindle the entire pit was filled with molding sand to the floor line, loosely on the inside, and rammed firmly on the outside. The center was dug out with a shovel, the sweep set in place on the spindle and the inside of the mold swept to the proper radius, the cope joint struck off, wet parting sand slicked on the surface, and the lifting arbor set in place as shown in Fig. 5.

To insure keeping the arbor a proper distance from the inside face of the mold, four wood blocks each 2 inches thick were set under the arbor and removed when the cope was lifted off. Four iron blocks 3 x 3 inches, of the proper



Figs. 6 and 7—Plan and sectional views of bottom head. Figs. 8 and 9—Plan and elevation views of manhole shell. Figs. 10 and 11—Plan and elevation views of tube shell

height, were placed on top of the arbor for wedging to the bars of the cope. The cope was rammed and lifted off with the core firmly bolted to it, finished overhead, and dried in the oven. The bottom half of the mold was swept out in a similar manner, well vented to the coke bed and dried in the floor with a gas burner, although charcoal or coke may be used for the purpose with good results.

Both parts of the mold were blacked after being dried as the kind of sand used does not lend itself to being blacked when in the green state. When the mold was closed binders were set on top of the cope and bolted firmly to the binders in the bottom of the pit. The top head required about 5000 pounds of metal to pour. The casting when cleaned weighed 4150 pounds.

Instead of making a runner as for gray iron with a deep dish at the back of the runner box, the bottom of the runner was sloped toward the pouring gates because antimonial lead, while apparently hot enough to run knitting needles, chills quickly in running over a blackened dry sand surface. As the best results are obtained when the metal is poured at the lowest temperature consistent with safety it is better to make provisions for forcing the metal into the mold.

Grade of Sand Is Important

The grade of sand used is one of the most important factors in making these castings. Antimonial lead melts at a temperature of 720 degrees Fahr., therefore the sand does not have to withstand a high temperaure, but our former experience taught us that we should have an extremely open sand of high permeability to allow the free passage of gas and air generated.

Antimonial lead does not generate as much gas as gray iron. The gas and steam are forced away from the mold more in the form of a vapor, but they must be released quickly. The most important detail we had to consider was to use a facing and backing sand that would yield easily when the metal in the mold expanded. Sand must crush almost instantaneously when

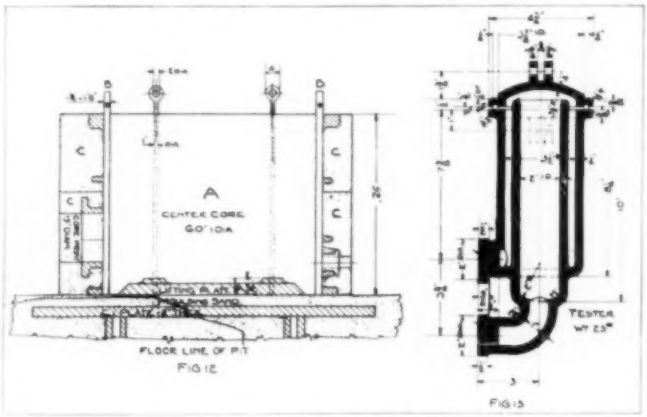


Fig. 12—Inside part of the mold was lifted on a plate, while the outside was formed with a set of dry sand cores. Fig. 13—Great difficulty was experienced in removing the core from this casting

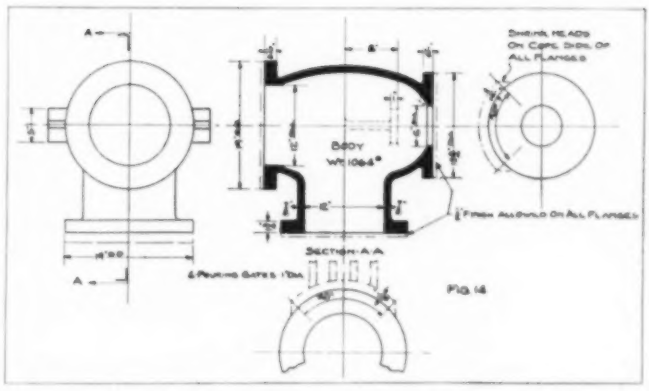


Fig. 14—The body casting was poured through four small gates on top of one flange. Extensions to the flanges as shown at the bottom and at the right served as feeders

contraction begins to avoid rupture. The mold also had to be strong enough to resist the static pressure of the metal. Antimonial lead is approximately 60 per cent heavier than gray iron, a cubic inch of iron weighing 0.260 pound as compared to 0.415 pound for antimonial lead.

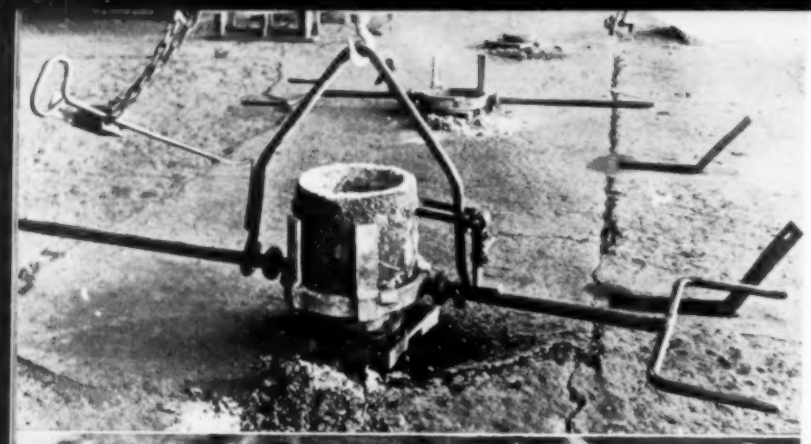
Instead of a sand with a high bond we used a friable material just strong enough to hold together when properly secured. A mixture of the following sands for facing gave excellent results, but test cores should be made first for such work as the sands in different localities vary widely.

	Per Cent
New molding sand, No. 5	20
Michigan City core sand	40
Coarse bank sand	40

The sand was bonded with a cereal binder and pitch core compound, equal parts of each at a ratio of one part of the binder to 40 parts of sand. The cereal binder furnished sufficient green bond to prevent the bulky cores from sagging and also facilitated cleaning the cores from the castings. The sand was wet with one part molasses to 30 parts of water, and the whole mass well mixed in a double roller mill. Molds and cores required greater care in securing because of the maximum amount of cinders and coke in the cores and molds which necessitated the use of extra rods and gaggers.

Not the least important part of making such heavy antimonial lead castings is estimating the proper amount of contraction to allow. We estimated the castings would contract at least 3/16-inch per foot, but as there were so many finished surfaces especially on the larger castings we allowed ¼-inch per foot.

However, ⅛-inch per foot would have been ample. The top head, the first casting made, contracted but one half of what we estimated, probably influenced by the mass of the casting. Fortunately, this over-size did not seriously affect the finished size of the casting. Flanges of all the castings were reinforced on the inside to allow for any variation in contraction, a precaution we usually take on all large flanged castings whether gray (*Please turn to page* 80)



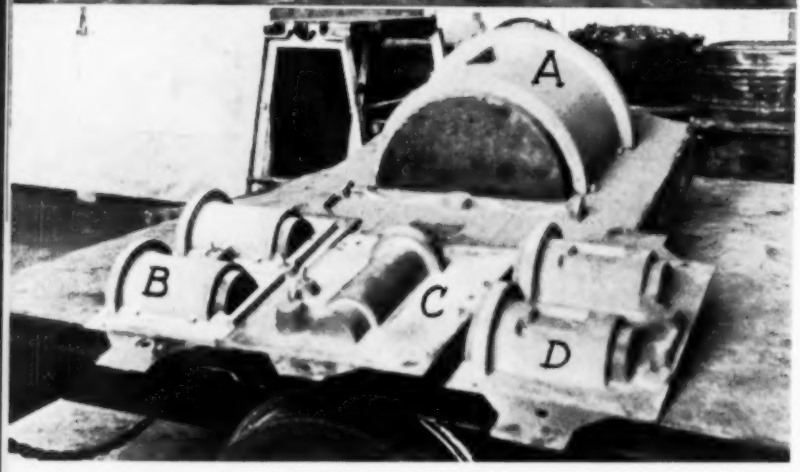


Fig. 1 (Top)—Crucibles are held in specially designed shanks. Fig. 2 (Center)—Copper castings at left are fed from central riser. Half bearing on right is poured through storge gate. Fig. 3 (Bottom)—Gate types are varied to suit conditions

Gating Important Feature in Nonferrous Shop

IN THE extensive group of buildings constituting the Erie, Pa., plant of the General Electric Co., one building over 800 feet in length houses all foundry activities. In a redistribution of the work several years ago most of the gray iron castings were allocated to plants of the company in Schenectady, N. Y., and West Lynn, Mass. The former extensive gray iron foundry was converted into a unit for the manufacture of refrigerators. The resulting reduced volume of gray iron castings now is made in part of the large building formerly devoted exclusively to the production of malleable iron and nonferrous castings.

All the malleable iron castings for the company are made in the Erie plant, but a great floor space area was made available for other purposes several years ago when the former orthodox annealing method was superseded by an electric installation in which the annealing cycle is completed in 32 hours instead of the 7 to 9 days required under conditions prevailing previously. The installation was described in the Sept. 1, 1931 issue of THE FOUNDRY.

The metal is melted in air furnaces fired with powdered coal. Hard iron castings are loaded in containers without any packing material and passed through the annealing cycle. The annealed castings are tumbled, ground and cleaned in the usual manner and then subjected to a minute and critical inspection for surface imperfections and dimensional accuracy. Distorted castings are straightened in power presses and the openings in many castings are broached to bring them within the required tolerances of a few thousandths of an inch.

The south end section of the foundry is devoted to the production of brass, bronze and aluminum castings in a wide variety of sizes, shapes and composition. It is essentially a jobbing foundry since long running jobs are the exception rather than the rule. This is partly due to the wide range of manufacturing activity in which the company is engaged, and partly due to the fact that changes and improvements constantly are taking place in the construction of the machinery and equipment for this wide field.

Explore New Industrial Fields

Since its practical inception approximately half a century ago, the electrical industry probably has plowed up more new ground and introduced more improvements in the manipulation of metals and other materials, than any other major industry. The research and engineering staffs of the General Electric Co., constantly are engaged in exploring new fields. Results of their theories and suggestions are converted into tangible shape in the various manufacturing plants. Where practical application of any device or material apparently has been developed to the limit, further effort is applied to reduce the cost of manufacture.

Unusually high standards of acceptance coupled with rigid control and inspection of materials and methods at every stage in the cycle of production are reflected in exceptionally high class castings. Operation of the nonferrous foundry is under the direction of R. R. Clarke.

a foundryman of wide experience and a frequent contributor to THE FOUNDRY and other technical publications.

Metal is melted in two 750-pound capacity electric furnaces made by the Detroit Electric Furnace Co., Detroit, and in a battery of nine crucible pit furnaces supplied by the Alfred Fischer Furnaces Inc., Chicago. One of the furnaces is fired with natural gas while the remainder are fired with oil. A No. 80 pot is used in these furnaces. According to a system adopted by American crucible manufacturers, the number of a crucible multiplied by 3 represents the metal holding capacity of the crucible in pounds. Hence the capacity of a No. 80 crucible is 240 pounds. This refers to brass and bronze and is simply a general approximation since various combinations in these metals range in weight from yellow brass half and half copper and zinc which weighs 512 pounds per cubic foot to a bronze 90 per cent copper and 10 per cent tin which weighs 552 pounds per cubic foot. Aluminum bulk for bulk weighs approximately one third that of bronze. To be exact the weight is 166.5 pounds per cubic foot. A pot that will hold 240 pounds of bronze will hold only 80 pounds of aluminum. In other words the number of the pot corresponds to the holding capacity in pounds.

Stir Leaded Bronze with Skimmer

Each pot is lifted from the furnace and lowered on to an iron plate — a snap flask weight on the floor in the vicinity on which the shank also rests. Here it is engaged by a bail suspended from a small hoist riding on a monorail which extends to the various molding floors. The dross and charcoal covering are skimmed from the top of the pot in the furnace room. In leaded bronze mixtures for bearings the skimmer is pushed down into the metal and whirled around a few times to insure a more intimate mixture of the lead with the bronze. This operation also is repeated once or twice later as the pot is conveyed along the line of molds.

Some of these mixtures contain as high as 30 per cent lead, while in others the amount is only 5 per cent. An average mixture contains 15 per cent lead, 5 per cent tin and 80 per cent copper. The lead is held in suspension mechanically and on account of its greater weight would sink to the bottom of the pot if the mixture was not stirred vigorously.

The bail and shank shown in Fig. 1 present several rather unusual features. The handle welded to the bail at the left enables one man to steady the ladle with one hand while he manipulates a skimmer with the other hand. The two upright members support the pot while in an inclined position and prevent it from wabbling or slipping even if it is not a tight fit in the shank. Two solid rings welded on the shank on either side of the pot prevent the bail from working sideways and thus disturbing the balance. Since the shank engages the pot below the bilge it is apparent that a filled pot is top heavy and is held in position only so long as the operator maintains a firm grip on the double handles at the right. The device shown engaging the bail at the right supplies the necessary safety factor. The upright member of this device is welded to the shank. The upper part is movable and readily may be thrown into or out of engagement with the bail. It locks the pot securely in position while the attendant is shoving the pot from the furnace room to any designated point on the molding floor.

Metal in all the castings must conform to chemical specifications, and in the majority of instances to closely held physical standards of transverse and tensile strength, elongation, and reduction in area. Machining allowance rarely exceeds a sufficient amount for a light cleaning up cut.

Under these conditions it is apparent that close control is necessary in the selection and melting of the raw materials. No foreign scrap is employed. Shop scrap is collected in containers suitably marked to indicate the composition. Similarly copper and other scrap metals from the various machine and fabrication shops arrive in the foundry (*Please turn to page* 83)

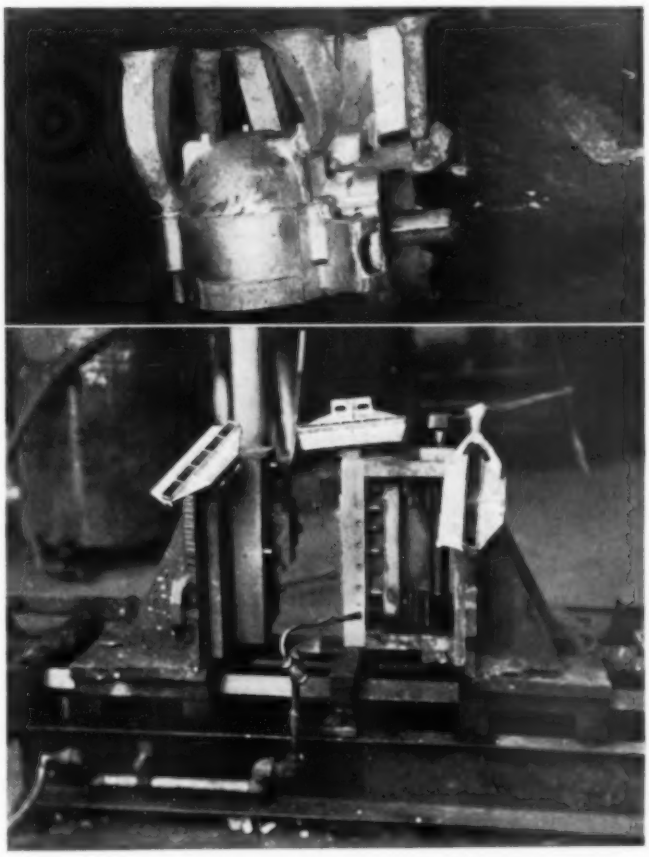


Fig. 4 (Above)—Large number of feeders required to secure solid aluminum casting. Fig. 5 (Below)—Extremely accurate castings are made in a permanent mold

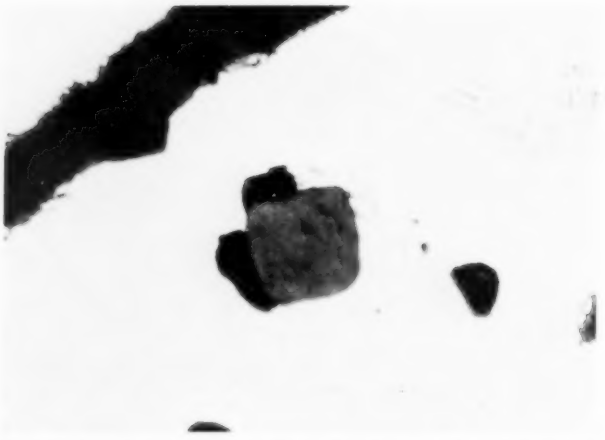


Fig. 62—Inclusion consisting largely of manganese sulphide

GRAY CAST IRON

By JOHN W. BOLTON

Chapter IV (Effects of Manganese)

MANGANESE, a gray metallic element, has a specific gravity of 7.42 and melts at 2290 degrees Fahr. The atomic weight is 54.93, close to that of iron.

Manganese exists in three allotropic modifications. The alpha modification, stable from room temperature to about 1430 degrees Fahr. is shown by X-ray study to exist as a complex body centered cubic lattice having 58 atoms in the unit cell. The side of the unit cell is 8.894 Angstrom units.

As shown in Fig. 63—Walters and Wells—*Transactions* A.S.M., 1934—pure iron and manganese form a continuous series of solid solutions throughout the range of percentage of interest to the iron founder. In small percentages, manganese has little effect on the mechanical properties of pure iron, increasing the ultimate strength, limit of proportionality and brinell hardness slightly and having little effect on ductility according to Neville and Cain—Bureau Standards Scientific Paper No. 453, pages 411-443, 1922. Manganese lowers the temperature at which gamma iron exists, as is quite evident from the diagram.

Manganese and carbon unite to form a carbide, formula Mn_3C. This carbide is structurally similar to the carbide of iron, cementite, Fe_3C. Shimura has found that the space lattices of iron carbide in iron carbon alloys and the manganiferous cementite (largely manganese carbide) of spiegeleisen both belong to the orthorhombic system. Each is composed of four molecules, and the cell dimensions are similar,—that of the manganiferous cementite being a trifle smaller. Manganese has a greater affinity than pure iron for carbon. In pure iron carbon alloys, the carbides of iron and manganese are associated intimately.

In the pure iron carbon alloys manganese lowers the temperature of pearlitic transformation, and when present in sufficient amounts, suppresses it entirely, either martensite or austenite being formed, depending on the manganese content and on the rate of cooling. That effect of manganese has been indicated diagrammatically by the diagram for air cooled samples given

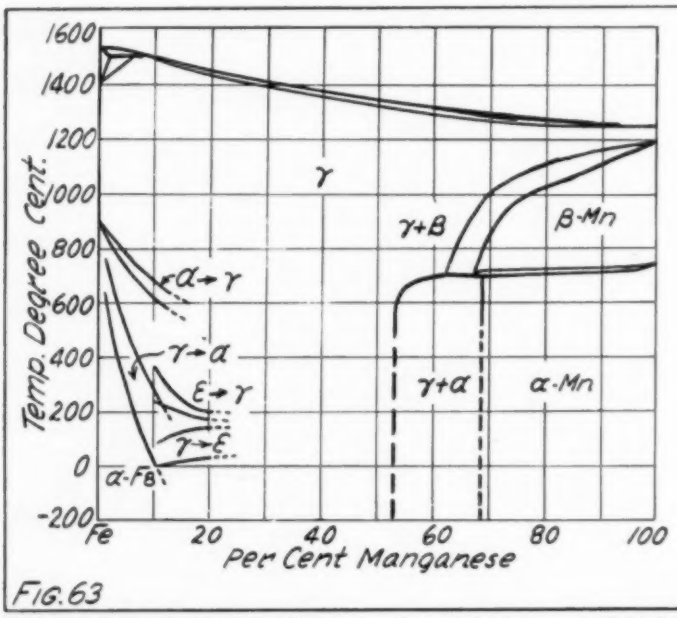


FIG. 63

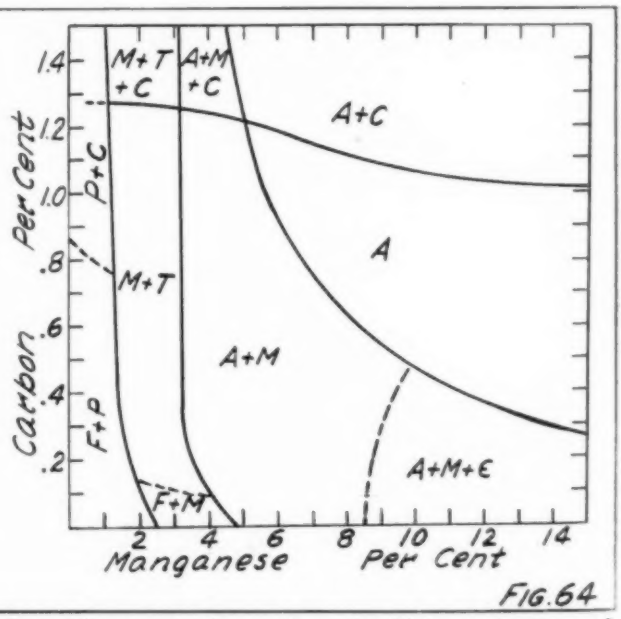


FIG. 64

Fig. 63—Iron-manganese diagram. Low manganese end is based on dilatometric observations, the high manganese end on microscopic and X-ray examination of quenched alloys. Delta region and solidus-liquidus redrawn from Gayler's data.

Fig. 64—Extra-equilibrium constitution chart for condition resulting from free air cool from 1740 degrees Fahr.

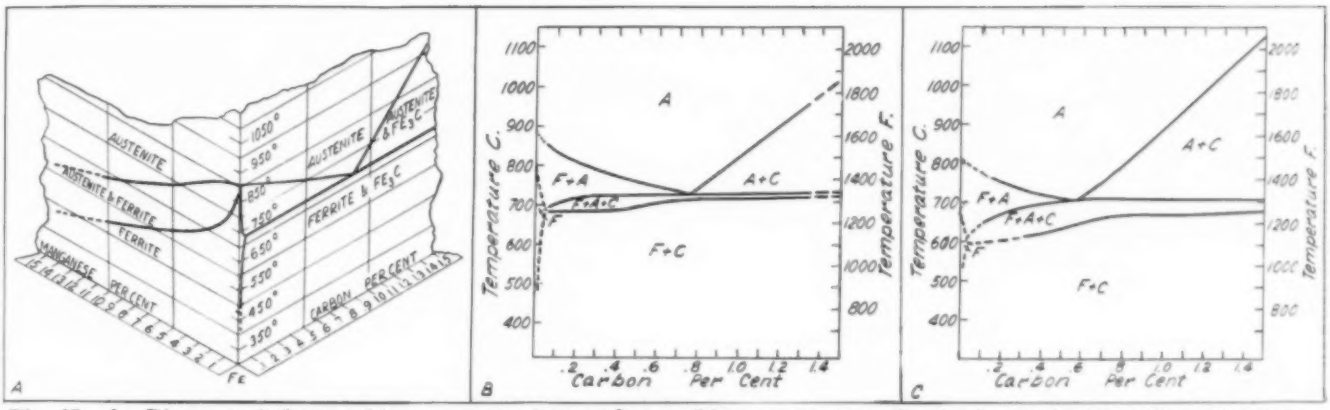


Fig. 65—A—Diagram of the two binary systems iron-carbon and iron manganese. B—Section of the three dimensional diagram for 1 per cent manganese. C—Section of the three dimensional diagram for 3.8 per cent manganese

by Bain, Davenport and Waring. This is shown in Fig. 64. The symbols are *F*—ferrite, *P*—pearlite, *M*—martensite, *A*—austenite, and *C*—cementite. Manganese also lowers the amount of carbon required for the eutectoid pearlite about 0.05 per cent for each per cent of manganese present.

Ternary diagram sections of the iron carbon and manganese system near the transformation range, after Bain, Davenport and Waring is shown in Fig. 65. (A B and C)

Manganese and sulphur have a strong affinity for one another — so much so that in the presence of moderate excess of manganese practically all the sulphur present occurs as manganese sulphide, MnS. This sulphide has a rather high melting point, 2930 degrees Fahr. according to Shibata—*Technical Reports,* Tokio Imperial University, No. 4, 1928. The same investigator reports the melting point of iron sulphides, FeS as 2125 degrees Fahr., and has published an equilibrium diagram for the system FeS—MnS. The earlier diagram of Rohl is shown in Fig. 66. The sulphide of manganese, practically insoluble in molten iron carbon alloys, separates as small globules. Due to their low specific gravity (about 3.99, McCance) these globules tend to float to the surface of the molten metal, affording a simple explanation for the frequently observed occurrence of high sulphur and manganese content near the cope side in heavy castings. The fact that manganese sulphide floats also affords an opportunity for sulphur removal by suitable slags.

Sulphide of manganese in ferrous metals usually occurs as small particles of dove gray color. Fig. 62 shows an inclusion consisting largely of manganese sulphide, as found in a sample of gray iron.

Manganese combines readily with oxygen, and in oxidized metal some manganese oxide is present. This usually is found associated with silicon oxides as manganese silicate inclusions, and in other complex inclusion forms. The subject of inclusions of manganese sulphides, manganese silicates and other substances has been carefully studied by Wohrman—*Transactions,* A.S.S.T., Vol. XIV, 1928. It is evident from his and other's studies that few inclusions are composed entirely of one substance.

Occurs in Three or More Forms

Recapitulating, in the iron carbon alloys, manganese may occur in three or more forms. In the presence of sulphur, on cooling iron-carbon alloys, the high melting point manganese sulphide is formed first. The residual manganese then unites with carbon to form manganese carbide, a formation closely resembling the carbide of iron, cementite. In ferritic alloys the manganese also is found in solid solution in the ferrite. Increase in manganese content reduces the solidification temperature slightly and the eutectoid temperature rather rapidly.

All these reactions occur in the gray iron alloys as well as in the lower carbon series or steels. From an engineering and metallurgical viewpoint the effects of manganese on the carbon formations are important, since the mechanical properties of the metal depend in large degree on the amount, size and distribution of graphite flakes and on the condition of the matrix. (*Please turn to page* 84)

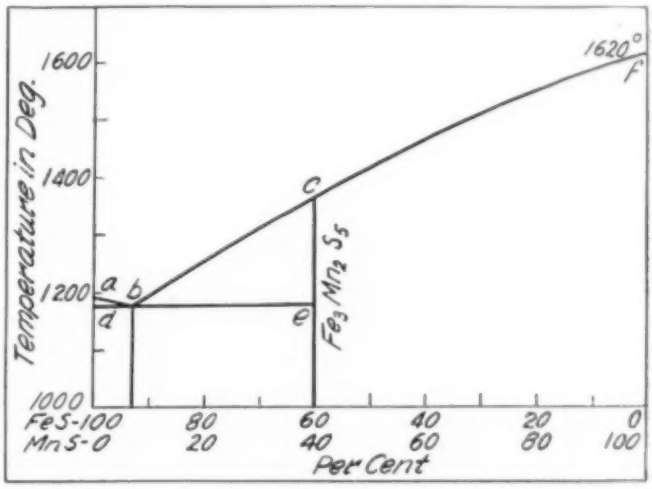


Fig. 66—Iron-sulphide manganese-sulphide diagram according to Rohl

Forms Simplify Foundry Accounting

Standard casting requisition carries all essential details to facilitate the work

By D. F. ZEHRUNG

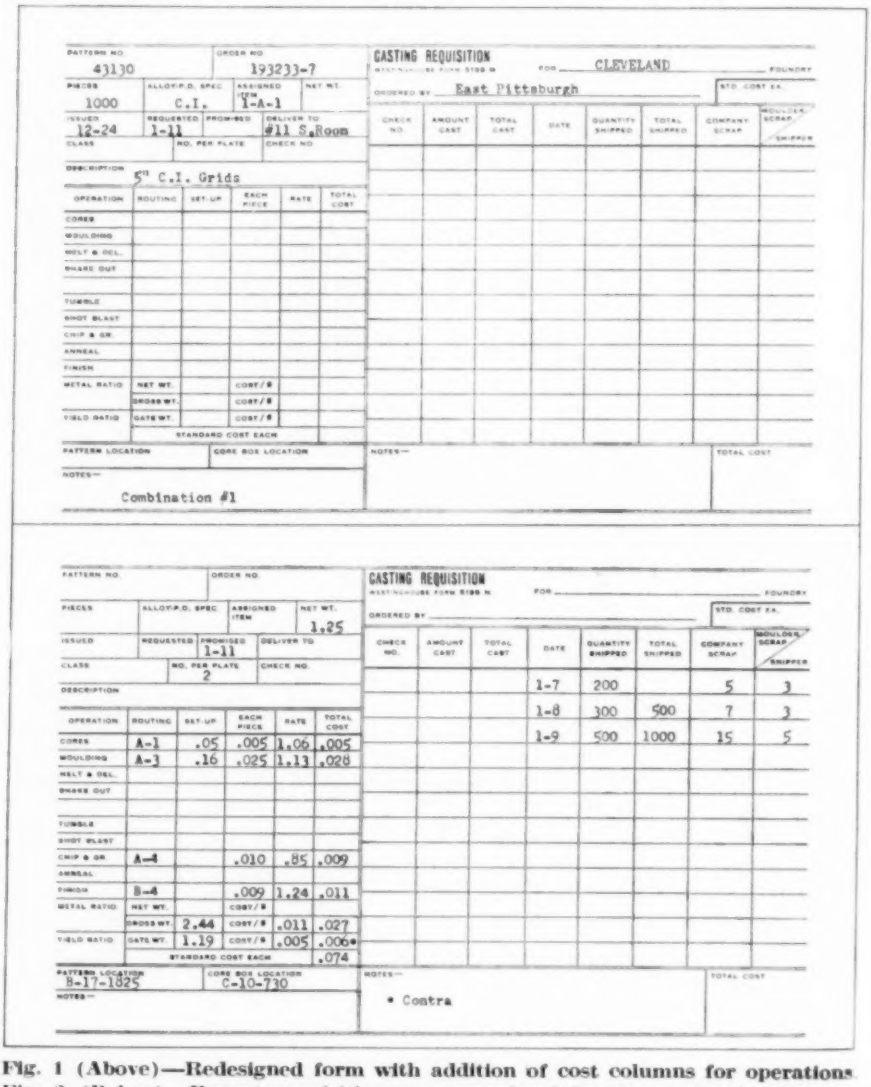
Westinghouse Electric & Mfg. Co., Cleveland

FOUNDRY accounting with the reputation of being distinctive, amplified by the practice of costing on a weight basis, causes most accountants to follow the conventional procedure. Simplicity of the weight method of costing admittedly is an important factor, but too frequently results in the fallacy of sustaining the loss on small, difficult, cored castings on the profit from the large, heavy, more simple castings. Consequently, any change in method must be simple to operate without sacrifice of accuracy.

Net weight of the casting has no direct relation to the actual cost. Likewise the net weight of the casting does not reflect the true cost of the metal content. Castings weighing 2 pounds net may require the melting and pouring of 5 pounds of metal. Costs which are the tools for management must reflect the true condition.

Confronted with these facts, the problem was to assimilate them without introducing burdensome payroll and cost procedure. Since there was a group incentive on all direct labor operations, it was obvious that if the manufacturing, payroll, and cost information could be issued with one writing, the procedure would be minimized. The casting requisition (hectograph) was redesigned to provide the required columns and spaces for control, and transcriptions were eliminated.

The redesigned form shown in the accompanying illustrations permitted the addition of cost columns for operations, as well as for metal factors, and satisfactory columns were provided for the recording of the quantity shipped and the scrap. Previously, the time study and cost cards were prepared by typing a special card in duplicate. This operation has been eliminated entirely. The scrap information was inserted in columns not used for other purposes, which easily (*Please turn to page* 89)



PATTERN NO. 43130 — ORDER NO. 193233-7 — CASTING REQUISITION — FOR CLEVELAND — FOUNDRY

PIECES 1000 — ALLOY P.D. SPEC. C.I. — ASSIGNED ITEM Y-A-1 — NET WT.

ISSUED 12-24 — REQUESTED 1-11 — PROMISED — DELIVER TO #11 S.Room

CLASS — NO. PER PLATE — CHECK NO.

DESCRIPTION 5" C.I. Grids

ORDERED BY East Pittsburgh — STD. COST EA.

OPERATION	ROUTING	SET-UP	EACH PIECE	RATE	TOTAL COST
CORES					
MOULDING					
MELT & DEL.					
SHAKE OUT					
TUMBLE					
SHOT BLAST					
CHIP & GR.					
ANNEAL					
FINISH					
METAL RATIO	NET WT.		COST/#		
	GROSS WT.		COST/#		
YIELD RATIO	GATE WT.		COST/#		
	STANDARD COST EACH				

CHECK NO.	AMOUNT CAST	TOTAL CAST	DATE	QUANTITY SHIPPED	TOTAL SHIPPED	COMPANY SCRAP	MOULDER'S SCRAP / SHIPPER

PATTERN LOCATION — CORE BOX LOCATION — NOTES— Combination #1 — TOTAL COST

PATTERN NO. — ORDER NO. — CASTING REQUISITION — FOR — FOUNDRY

PIECES — ALLOY P.D. SPEC. — ASSIGNED ITEM — NET WT. 1.25

ISSUED — REQUESTED — PROMISED 1-11 — DELIVER TO

CLASS — NO. PER PLATE 2 — CHECK NO.

DESCRIPTION — ORDERED BY — STD. COST EA.

OPERATION	ROUTING	SET-UP	EACH PIECE	RATE	TOTAL COST
CORES	A-1	.05	.005	1.06	.005
MOULDING	A-1	.16	.025	1.13	.028
MELT & DEL.					
SHAKE OUT					
TUMBLE					
SHOT BLAST					
CHIP & GR.	A-4		.010	.85	.009
ANNEAL					
FINISH	B-4		.009	1.24	.011
METAL RATIO	NET WT.		COST/#		
	GROSS WT.	2.44	COST/#	.011	.027
YIELD RATIO	GATE WT.	1.19	COST/#	.005	.006*
	STANDARD COST EACH				.074

CHECK NO.	AMOUNT CAST	TOTAL CAST	DATE	QUANTITY SHIPPED	TOTAL SHIPPED	COMPANY SCRAP	MOULDER'S SCRAP / SHIPPER
			1-7	200		5	3
			1-8	300	500	7	3
			1-9	500	1000	15	5

PATTERN LOCATION B-17-1825 — CORE BOX LOCATION C-10-730 — NOTES— * Contra — TOTAL COST

Fig. 1 (Above)—Redesigned form with addition of cost columns for operations
Fig. 2 (Below)—Repeat requisitions are completed by the production department with details added

Changes Practice in Car Wheels

Melting and annealing practice gives high class wheels from scrap mixtures

By HENRY MARIUS
Lenoir Car Works, Lenoir City, Tenn.

IN 1923 we cast our first chilled iron car wheels from an all scrap composition. Prejudice against this procedure was so strong we had to keep it secret from our own plant management. To add to our discomfort the experiment failed miserably.

The experimental wheels did not stand either the drop test or the thermal test. We became the laughing stock of the old timers who sincerely believed, though without reason based on facts, that chilled iron wheels cannot be made without pig iron, and further, that they cannot be made without blending at least three kinds of pig iron.

However, the old timers' fun did not last long. A diligent laboratory study of the wheel failures gave us the clue that the most probable cause of the failure was not a lack of pig iron *per se*, but rather lack of sufficient total carbon. These wheels showed a bare 3.00 per cent total carbon content, of which a little over 1.00 per cent was in combined form.

Carbon Content Too Low

The all scrap composition melted in the ordinary way without the advantage of high carbon, high silicon pig iron did not absorb the anticipated amount of carbon from the coke bed, nor was the ferrosilicon addition sufficient to produce a low temperature, slow setting iron. The low total carbon, or more correctly, the low ratio of total to combined carbon, produced wheels of too high shrinkage and enormous internal strains. The wheels set so rapidly that they actually showed incipient cracks caused by the terrific internal strains before the strain equalizing temperature of the annealing pits, approximately 1420 degrees Fahr., had time to exert its beneficial effect on the wheels. The annealing temperature was not high enough to do the wheels much good.

We centered experiments around melting all scrap mixtures on a much higher coke bed with a heavier dose of ferrosilicon and slowed down somewhat our melting rate. The idea was to produce hotter iron which would absorb more carbon from the surplus coke bed. We counted on the ferrosilicon, if not actually to graphitize, at least to promote a tendency toward graphitization of the surplus combined carbon resulting in a low temperature, slow setting iron.

Our experiments convinced us also that a higher annealing temperature than 1420 degrees Fahr., was necessary. Therefore the wheels were shaken out and pitted as hot as it was practical without bleeding at the hub. In a short time, by accumulation, the pit temperature was raised to 1575 degrees Fahr., and over.

Convinced the Unbelievers

The three *H's*, Hot melting, Hot shaking out, Hot pitting, produced wheels from an all scrap mixture that jolted the foundry beliefs of the old timers. These wheels showed uniform, surprising strength and tenacity under the drop and thermal tests — average number of blows 40 before wheel cracked — but old beliefs like old habits are hard to eradicate.

Old timers were still skeptical, contending that wheels made from an all scrap mixture were bound to have higher impurities, notably sulphur and phosphorus, and therefore could not be good wheels. Furthermore, they doubted if wheels made altogether from worn out scrap would have the same resistance to fatigue as wheels that contained at least a certain amount of virgin metal in the form of pig iron. Without doubt these wheels did have a somewhat higher percentage of sulphur and phosphorus, but in the author's opinion these impurities were within reasonable bounds. We never subscribed much to arguments that a few hundredths of one per cent — more or less — of these impurities could exert any influence one way or another on the iron. We always have believed — and the facts are in our favor — that the physical properties of wheel iron — and for that matter any kind of iron — are influenced enormously by the element carbon and by melting, pitting and pouring temperature. By comparison, the effect

of a few hundredths of one per cent sulphur or phosphorus are infinitesimal. Their undue prominence in specifications are not justified.

In 1923 we had no facts to refute the contention that an all scrap made wheel could not have the same resistance to fatigue, and consequently the same wearing qualities as a wheel that contained pig iron. However, we were fortunate in that we were dealing with two open minded gentlemen, J. C. Ramage, engineer of tests, Southern Railroad Co., and Z. B. Wilson, manager of the Lenoir Car Works. They accepted our logic and agreed there was nothing much to fear in the matter of wear and resistance to fatigue from these all scrap made wheels that showed such good results under drop and thermal tests. Therefore, gradually we proceeded to eliminate pig iron altogether from our wheel mixture. Subsequent service of our wheels in the past decade has proved our logic was correct.

Pig Iron Needed in the Foundry

We would like to stress the point that it was not dissatisfaction with results obtained with pig iron that suggested the idea of abandoning it altogether. It was simply an economic question arising from the fact that our main customer had for disposal a rather unlimited amount of good scrap at a very low price. We felt there must be some way to make good use of this scrap, particularly since the source of supply could be counted on as permanent. This is not to be taken as a suggestion that foundrymen in general abandon the use of pig iron. Problems surrounding all scrap mixtures are many, requiring laboratory control and higher technical skill than is within the domain of the average foundryman. The pig iron producer relieves his customer — the foundryman — from the major metallurgical problems affecting quality castings. Therefore the price differential between pig iron and scrap is justifiable to the average foundryman.

Referring to undue specification severity on the traditional impurities sulphur and phosphorus, we do not mean to encourage higher impurity limits in wheel specifications. We do want to stress the fact, most emphatically, that the quality of a wheel depends so much on the carbon element and heat treatment, that by comparison, the effect of a small variation in the quantity of sulphur and phosphorus in the wheel is absolutely negligible.

The main problem of wheel casting is that of internal strains developed to a small extent by the wheel design, and to a larger extent by the unusual shrinkage of the chilled iron in the tread and flange and the gray iron of the plate and hub. This shrinkage, in turn, is in direct ratio to the quotient of combined carbon to the total carbon of the wheel. The less total carbon and the more combined carbon present, the more a wheel will shrink. This great shrinkage, in turn, will cause greater internal strain. Reciprocally, the less shrinkage a wheel has, the smaller the internal strain will be. A tape 0 or tape 1 wheel has enormously greater internal strain than a tape 7 or 8. Likewise, a wheel with 3.00 per cent total carbon, other things remaining equal, has a much higher shrinkage and correspondingly a much higher sum total of internal shrinkage or strains, than a wheel with 3.50 per cent total carbon. Thus — at least theoretically — the former wheels are weaker than the latter.

The usual argument is that the self annealing of the wheel in the pit equalizes strains due to shrinkage. We concede only the principle of that argument. Our experience has proved that the ensuing pit temperature from wheels that do not show more than 1400 degrees Fahr., at the plate when they go into the annealing pit — the practice even now among the best wheel makers — is not adequate to accomplish the full purpose of annealing.

This is particularly so when the wheels run a higher chill, or, are low in total carbon, that is below 3.25 per cent. This unfavorable condition is annoyingly aggravated in an all scrap mixture by the simple fact that the mixture lacks the beneficial effect of graphitization imparted to the wheel at the start from a generous quantity of pig iron, which has almost all its high carbon content in the graphitic state. Low carbon wheels when pitted at temperatures not higher than 1400 degrees Fahr., invariably have shown positive weakness under thermal and drop tests notwithstanding sulphur and phosphorus as low as 0.10 and 0.25 per cent, respectively.

Judged By Thermal and Drop Tests

A more rigid carbon specification then becomes quite apparent. So far as we know there is no better criterion concerning wheel quality than the thermal and drop tests.

Our experience indicates in general that before annealing, low total carbon produces weaker wheels because of greater internal strains. Wheels made from all scrap mixtures have a decided tendency to run a higher combined carbon, which has the same effect as low total carbon, that is, higher shrinkage and more strains. Low phosphorus and sulphur, by themselves are altogether ineffective under the foregoing fixed conditions.

Annealing temperatures of 1400 degrees Fahr., and below, while seemingly they have been effective when high carbon pig iron was used — resulting in high total, low combined carbon wheels — are ineffective on low total, high combined carbon wheels produced from all scrap. While they may equalize internal strains, they do not relieve them altogether, nor are they high enough to (*Please turn to page* 99)

Training Apprentices in England

As result of long experience courses placed under control of the educational department

By A. P M. FLEMING

THE systematic training of young people, which became so deeply rooted in the industrial system of the Middle Ages, is recognized as an essential feature of industrial Britain. Training through apprenticeship is the common practice in most industries, but it is perhaps most clearly defined in the engineering and allied trades. With the development of Watt's steam engine toward the end of the eighteenth century came a need for workers skilled in metal working. Early in the nineteenth century the generation of engineering craftsmen that had sprung up during the industrial revolution found that they required technical knowledge of materials and of the underlying principles of the machinery produced. To supply this need the Mechanics Institutes, the first of which was opened in 1823, were set up to provide evening technical instruction.

The system of engineering apprenticeship employed at that time permitted a lad to enter a works at the school-leaving age and serve at a trade up to the age of 21 years, acquiring such technical instruction as was necessary by attendance at the evening classes. These students eventually became masters and employers; the leading industrialists and engineers of a generation or so ago were almost entirely of that type.

At the opening of the present century the widening horizon of science, and particularly the growth of electrical engineering, led to a new demand for men of sound scientific and technical training, whose future was to be devoted to the design and development of engineering machinery rather than to the manual labor required in its construction. Today throughout the engineering industry of Great Britain, there is a clear division of training between those who follow engineering in a professional sense and are trained for it on the same lines as a doctor or lawyer or any other of the professions, and those who are trained for the primary purpose of becoming skilled craftsmen. At the same time there is a bridge between the two grades whereby the young man of ability, energy, and initiative, may graduate through the medium of evening studies from the craftsman rank into the professional group.

WITH an acute shortage of trained men facing the foundry industry of the United States, a study of methods followed in England should prove of considerable interest. The author is director of research and education, Metropolitan-Vickers Electrical Co., Manchester, England, and therefore speaks with authority on methods employed in Great Britain. This article is reproduced through the courtesy of the Metropolitan Life Insurance Co., New York, and was presented in the publication of that company entitled "Executives Service Bulletin" for August, 1935.

Educated To Become Craftsmen

Considering first the apprentice training of those who desire to become craftsmen, the educational system in Great Britain permits youths to leave school on passing the age of 14, and a large number of youths proceed into various occupations at this age. Others who have entered junior technical schools at 12 or 13 years will continue their education up to the age of 15 or 16 years, and thereby obtain preliminary instruction in matters pertaining to the various trades and industries in their district.

Those who seek artisan apprenticeship in the skilled trades must be from 14 to 16 years of age and in the various engineering trades such as turning, fitting, molding, patternmaking, instrument-making, etc., apprenticeship terminates at the age of 21 years.

For more than a quarter of a century it has been the consistent policy of the company to give serious attention to the selection and training of its apprentices. The courses of training have been laid down as a result of long experience and are under the control of the education department created in 1916. It is our practice to select apprentices with great care, having regard to physique and general health, intelligence, scholastic ability, and character. The education department (one of the activities of which is employment, se-

(*Please turn to page* 94)

Fig. 1—Pattern for the slag ladle is constructed in skeleton form

Makes Corrugated Slag Ladles

By PAT DWYER

SOME of the claims advanced for a special type of slag ladle made exclusively by the Mackintosh-Hemphill Co., at its Midland, Pa., steel foundry, were presented in the third section of this series published in the August issue of THE FOUNDRY. The ladle is made in various sizes to meet customer's requirements. Several sections of the flask equipment employed in making the mold are shown in Fig. 3. The pattern shown in Fig. 1 is for a casting 9 feet 6 inches high, 10 feet 3 inches in diameter at the bottom, 5 feet diameter at the top, 2¼ inches thick, 16 flutes or corrugations and weight 10 tons.

The pattern is of conventional skeleton construction, split vertically through the center, and horizontally under the cap for convenience in handling. The various lugs and brackets are screwed temporarily in place. Later the screws are removed after these pieces have been surrounded by a sufficient amount of sand to hold them in place. A wide band at the bottom and a narrower band near the top are built to the exact contour of the desired casting. These bands serve as guides for the sweeps or strickles employed by the molder in forming the upright faces of the mold and core. These bands made up of overlapping segments glued and screwed firmly together impart rigidity to the pattern and hold it to a true circle. The main upright members of the frame are further braced by three horizontal strips spaced at suitable intervals.

Whether one of these castings is molded bottom up or bottom down a considerable amount of flask equipment is required. In the present instance the mold is made bottom up, that is in the position in which the pattern is shown in Fig. 1. The free hand sectional view Fig. 2 indicates in a general way the equipment required and the manner in which the mold is assembled. An arbor is bolted to the bottom plate to form the inside of the mold and to reduce the amount of sand required. The volume of sand in the outside part of the mold also is reduced by using smaller flask rings around the top.

Flask in Several Sections

Each of the flask rings for the lower part of the mold and shown in Fig. 3, is 21 inches high, 12 feet diameter on the inside, 14 feet diameter over the flanges on the outside, 2½-inch thickness of metal and weighs 11,400 pounds. Each section is a complete ring with a sand strip projecting from the inside bottom edge and four solid cast handles on the outside for attaching the crane chains.

These castings were molded with a sweep for the inside and a set of cores for the outside. A level bed first was swept in the bottom of a shallow pit. A strong wood segment of a circle attached to a sweep arm was placed on the bed and sand was rammed on the inside to the desired height. The segment was moved around to successive positions and the operation repeated until the entire circle was formed. The spindle

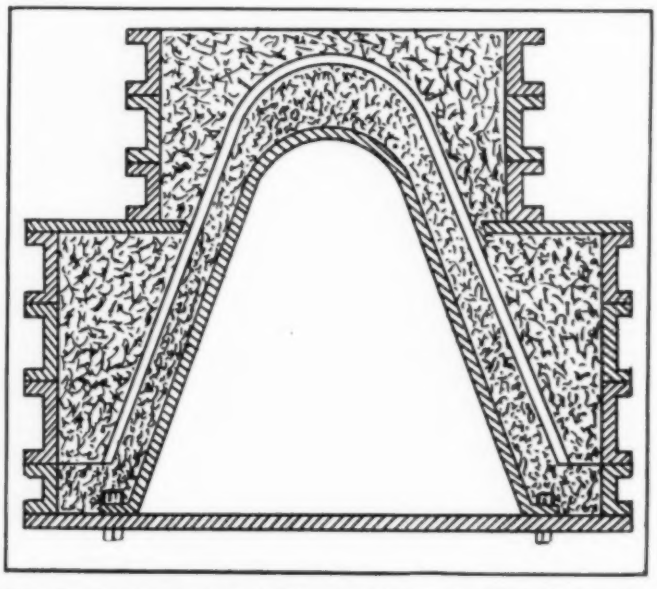


Fig. 2—Sectional view showing method of constructing mold for slag ladle

and sweep segment then were removed and a number of cores similar to that shown in Fig. 4 were lowered into position with the points of the vent cores touching the inner body of sand. Four of these cores held suitable cavities for forming the handles. Sand then was rammed back of the cores. Flat segment cover cores were placed on top followed by a covering ring and weights.

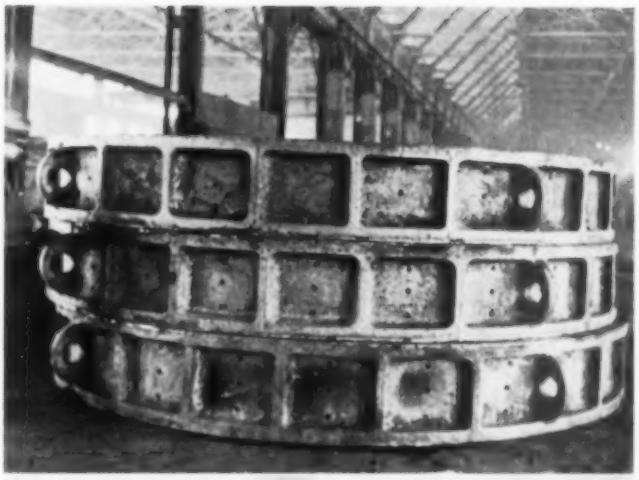
In making the mold for the slag ladle the bottom plate is leveled on the bottom of a pit and the inside dome or arbor, made up of several sections, is bolted in place. The bottom or drag flask ring then is placed on the plate and sand is rammed and struck off flush with the upper edge of the flange. The slag pot pattern is lowered into place and rests on this prepared surface. Sand is rammed between the pattern and the arbor and struck off flush with the outside surface of the pattern. Short straightedges, also known as strickles are employed to form the flutes or corrugations. Curved strickles cut the sand to the desired contour over the dome. The finished surface is covered with sheets of paper to form a parting.

Single Feeder Placed on Top

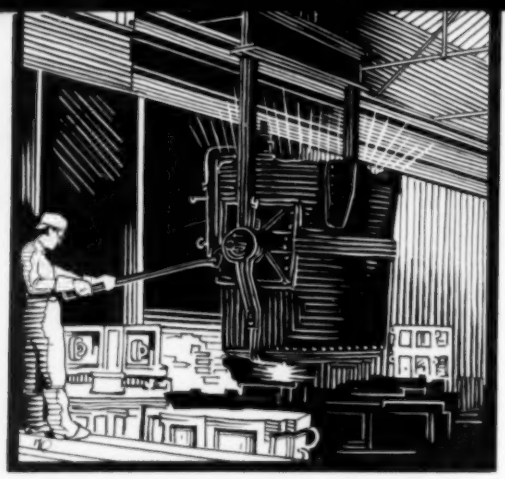
Three of the large flask rings are lowered into place on the drag and rammed full of sand. The top surface is struck off flat and a heavy steel ring plate lowered into place. Smaller flasks are built up on the ring, filled with sand and rammed in the usual manner. A single feeding riser is placed on the top in the center. A single long sprue extends from an opening in the plate to the joint line at the bottom. Later, after the mold is closed, this runner or sprue is extended to the required height in a number of small rings or flasks.

The outside part of the mold made up of the large and small rings is lifted away as a unit and placed temporarily on suitable stands while the molder finishes the surface and repairs any broken parts. The surface then is sprayed with silica wash and that part of the mold is placed on a car which is pulled into one of the drying ovens by a cable attached to the crane and reeved through a sheave anchored in the floor.

Before removing the pattern from that part of the mold still in the pit, it is necessary to remove the sand from between the ribs of the skeleton. This also automatically forms the space later to be occupied by the metal in the casting. The method for removing the sand is shown in Fig. 8, a typical section taken at practically any part of the upright wall of the mold. The three steps are shown in succession at *A*, *B* and *C*. *A* shows the (*Please turn to page* 96)



Reading down—Fig. 3—Sections of flask for ladle mold. Fig. 4—Dry sand cores formed the outside of the flask mold. Fig. 5—Machine and patterns for making pipe balls. Fig. 6—Floor of pipe ball molds



QUESTIONS and ANSWERS

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Iron Elbow Casting Is Honeycombed with Small Holes

We are forwarding a 1¾-inch cast iron elbow which is honeycombed completely, but which presents a smooth skin on the outside. We shall appreciate your opinion on the cause. In several areas the iron is white.

It would be interesting to know whether this casting is an individual freak, or if a considerable number showed the same characteristics. The holes are caused by gas or steam. If a great number of castings are defective the trouble probably is caused by faulty melting conditions, low bed, high blast and the presence of thin, rusty steel in the charge. The metal is oxidized, full of gas and in this respect resembles what is known as wild steel.

If the casting is from a single mold, or a few molds poured from the same ladle, the trouble may have been caused by a wet lining in the ladle. The iron boils violently and carries entrapped steam into the mold. Presence of shot in some of the cavities supports this contention, which is further confirmed by the fact that at several points the metal is chilled.

A third hypothesis, rather far fetched, but still possible is that the metal came into contact with wood on its passage through the sprue or gates. A piece of wood concealed close to the surface of the sand would burn violently and the resulting gas would be carried into the mold cavity entrapped in the iron. If the sprue lies close to the wood jacket, or the wood side of the flask and if the sand is soft behind the sprue the iron will come into contact with the wood and produce the same result.

Without a knowledge of all the conditions it is impossible to set up a dogmatic opinion, but personally we are inclined to favor the wet ladle theory as the most plausible. Certainly the casting more closely resembles a piece of cheese than any other in our experience with the exception of castings made in the early days from wild bessemer steel.

Spongy Castings Result From Incorrect Melting Methods

Recently we have experienced considerable difficulty with defective metal in machinery name plates, the castings being spongy. Will you kindly give an opinion as to what might be the cause of our difficulty?

You do not state the alloy from which these name plates are cast, but we presume it is one of the red brasses commonly used for that purpose.

The fracture clearly indicates that the metal has been gassed in melting. Have you changed your melting practice, or has dirt accumulated in the passages through which the air is supplied to the furnace? Possibly you are attempting to hold the metal in the furnace until additional molds are ready for pouring and consequently the metal is exposed to the furnace atmosphere a considerably longer period than has been your practice in the past.

If the air supply has been reduced by dirt accumulation or the plugging of flue passages, combustion is insufficient, the gases are underburnt and consequently easily are soluble in the melt. Upon solidification in the mold, that metal releases the dissolved gases, causing the appearance of what many call burnt metal, which is indicated by the discolored fracture.

We believe the correction of the difficulty is care in melting to insure a minimum amount of gas absorption and consequently a more fluid alloy. The increase in fluidity enables pouring at a lower temperature, or at least reduces the demand for an excessively high temperature. It is no uncommon experience for brass

foundries to attempt to increase the fluidity of the metal that they pour into name plates by raising the temperature and in doing so, they expose the metal to the furnace gases an undue length of time. It is better to increase the fluidity by careful melting practice that will insure minimum gas absorption. It is necessary to have fluid metal to run a thin casting of this kind; therefore, the melting practice must be good and every precaution should be taken to see that gases are not dissolved.

Many manufacturers of these thin walled castings add a small piece of phosphor copper to the bath just previous to pouring. Where the metal has not been gassed, the increased fluidity resulting from that addition permits a sharp, clean casting that polishes nicely without exposing the small pin holes resulting from the release of the dissolved gases that would have been present had the metal been dissolving gas during its exposure to the furnace atmosphere.

Production of Copper Castings Causes Difficulties

We are having considerable trouble making copper castings. These castings are used as welding forms and weigh from 40 to 80 pounds each, in the following sizes: 10-inch outside diameter, 5-inch inside diameter, 6½ inches long—also 10 inches outside diameter and 3 inches thick. They generally are made of scrap copper consisting of trolley wire and copper water pipe and are made in Albany sand.

Your question illustrates the trying problem of making sound castings from pure copper in sand molds. Copper is extremely sensitive to gassing during melting. If it absorbs gases while molten, these are liberated as it solidifies producing blow holes or bubbles in the casting.

The process of having copper just right for the production of sound castings is such a delicate one that almost all castings sold as commercially pure copper are in reality copper alloyed with a small amount of some other element, such as zinc, magnesium, etc. A common alloy used for the making of *pure* copper castings is: Copper 99 per cent, and zinc 1 per cent. Properly melted and carefully handled this alloy will produce a sound and relatively dense casting having the appearance of almost pure copper.

The fact that you are melting scrap means that you have a large area of your copper exposed to the furnace atmosphere during melting, and consequently a high percentage of copper oxide is present in the copper when melted. By adding a certain amount of deoxidizer the copper oxide is reduced, but the dissolved gases which have been absorbed during melting are not eliminated. A good practice, if the production will warrant the expense, is to melt the scrap copper and pour it off into ingots, remelt the ingots and add 1 per cent boron carbide, which will produce a pure copper casting of relatively high electrical conductivity; whereas the use of zinc or magnesium causes a rapid falling off of electrical conductivity.

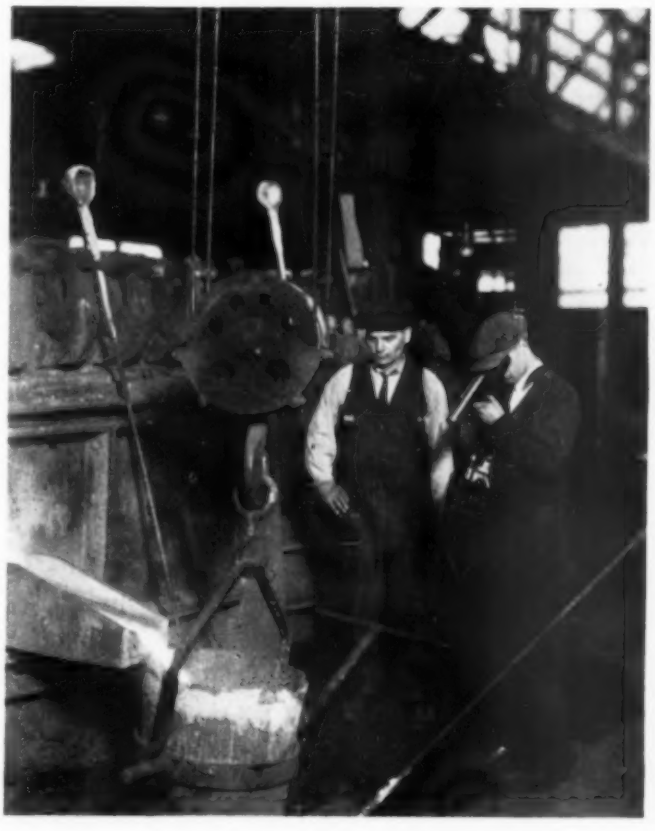
Molds for copper castings should be made from sand that is as dry as possible and should be well vented. Ample risers should be provided, for copper shrinks and needs to be well fed by a riser if the metal has been properly handled in the furnace. If the risers do not shrink, the castings are not sound.

Air Needed for Proper Melting in a 26-Inch Cupola

We have four tuyeres 4 x 9 inches, total area of 144 inches, in a cupola lined to 26 inches. What volume of air will insure the best melting conditions? We are thinking of installing a turbine type blower.

Under proper conditions the melting speed of a cupola may be reckoned as 10 pounds per square inch of area per hour. The area is taken at the melting zone 6 to 8 inches above the tuyeres. In this instance the area is 26 x 26 x 0.7854 = 530 inches. Multiplied by 10 gives a potential melting speed of 5300 pounds per hour. Under the same conditions 160 pounds of carbon and 425 pounds of oxygen will melt 1 ton of iron per hour. Where the coke contains 80 per cent carbon, 200 pounds will be required.

Air contains approximately 23 per cent oxygen, therefore 1840 pounds of air will ba required to supply the 425 pounds of oxygen. At 60 degrees Fahr. and 14.7 pounds barometric



pressure 1840 pounds of air equals 24,000 cubic feet. With these factors as a base it is apparent that your blower should deliver 63,600 cubic feet of air per hour, or 1060 cubic feet per minute. This amount may vary to some extent from time to time, depending on the temperature and humidity of the air and the carbon content of the coke.

Calculate Weight Of Gray Iron Castings

Where can we find data on the method of figuring the weight of gray iron castings from the master patterns, also the method for figuring the gating area.

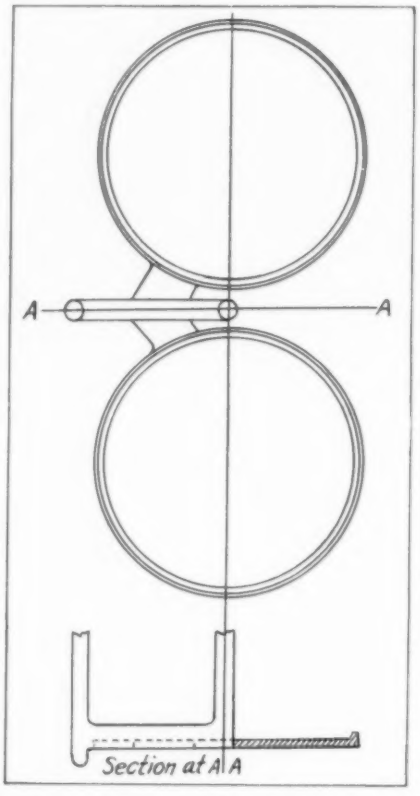
Where the master pattern is wood and without core prints, the simplest method for calculating the weight of the anticipated casting is to weigh the pattern and then multiply the figure thus obtained by a certain figure depending on the character of the wood. Thus for Nassau mahogany the figure is 10.7, Honduras mahogany 12.9, Spanish mahogany 8.5, red pine 12.5, white pine 16.7, yellow pine 14.1, oak 9.0. Tables showing the relative weight of wood and other metals, zinc, copper, brass, bronze, aluminum, lead and steel are contained in *The Foundrymen's Handbook* published by The Penton Publishing Co., Cleveland.

Where cores are present or where for any other reason the pattern cannot be weighed, the weight of the casting is found by calculating the cubical contents of the pattern in inches and multiplying the result by 0.26, the weight of a cubic inch of cast iron in pounds. For a fairly accurate approximation it is sufficient to divide the result showing the cubical content, by 4. For example a pattern containing 100 cubic inches of wood will produce a casting weighing 25 pounds. Methods, formulas, data and examples for calculating practically every shape of section are included in section 2 of the *Handbook*.

Use Storage Gate to Secure Casting

We are making small base castings 7 inches diameter, 3/16-inch thick with a rib around the perimeter on one side. The surface on these castings must be perfectly level and smooth. We cast them two in a flask in No. 1 Albany sand, but find that a large number show pin holes or rough areas on the surface. We shall appreciate your opinion on the probable cause of these defects. Possibly our gating system may be at fault.

If, as we assume from the sketch which accompanied your inquiry, that you are pouring the castings with the flat face on the cope side, and if further, this flat face is the only one which must be perfect, you can secure immediate relief by reversing the position of cope and drag, that is by placing the gates and sprue on the opposite side of your pattern plate. In this manner any small imperfections on the cope side will not affect the value of the casting.



Impurities are carried to the relief sprue in the center

Stove covers and many other castings of a similar character are molded and cast satisfactorily in this manner either with a small knife gate on top or one or two small branches from an ordinary gate at the side. However, if the pin holes and rough areas are large and if the casting has to be perfect on both sides, other factors in addition to the gates will have to be taken into consideration.

The sand you are using is quite suitable under favorable circumstances. A possibility exists that it is rammed too hard, or contains too much moisture, or the bottom board fits too tightly for the steam to escape rapidly. Any of these factors will cause rough spots on the drag side and pin holes in the cope. A checkup on these features may solve your problem. Another possible source of trouble may be loose sand washed in from the sprue or gates. The skimmer gate shown in the accompanying sketch will prevent this sand from entering the mold. The metal is poured down sprue and carries any loose sand or dust to the end of the runner where it floats up in the riser. The clean metal enters the molds on either side through the thin, flat gate.

Molding Methods Cause of Dirty Castings

Is pig iron essential to the production of good gray iron castings and if so what proportion should be used. If scrap is used alone what should be added to compensate for the pig iron. The foundry which makes our piston and cylinder rings weighing from 50 to 100 pounds melts all scrap charges and the rings are dirty and porous.

Composition of the iron in the cupola charge is reflected in the physical properties of the iron in the castings, that is it will be strong or weak, fine or coarse grained, hard or soft, but the composition of the iron bears no relation to whether a casting is clean or dirty. Under exceptional conditions the iron may be oxidized in the melting process and the resulting castings will show blowholes, but this applies to any mixture, whether a combination of pig and scrap or all scrap.

Satisfactory castings, which in your case means castings clean, solid and readily machinable may be produced from an all scrap charge provided the scrap is of the same approximate composition as the desired castings, that is silicon 2.50 per cent, sulphur under 0.10 per cent, phosphorus 0.60 per cent, manganese 0.50 to 0.60 per cent. With each successive melting the iron loses approximately 20 points in silicon and picks up a little sulphur. With each loss in silicon and pickup in sulphur the iron becomes harder, hence the necessity, under ordinary conditions of adding a certain amount of virgin pig iron, which is higher in silicon and lower in sulphur than the scrap. If no pig iron is available the same result may be secured by the addition of ferrosilicon, which may contain 50 or 80 per cent silicon.

The foregoing is offered for your general information, but as previously stated it has no immediate bearing on your present problem of dirty castings. The dirt and the blowholes in your rings are due to the molding practice. The sand is not sufficiently permeable, or is not vented properly, and as a result some of the steam boils through the metal in the mold. The dirt represents sand washed from the walls of the mold by the commotions and the holes represent trapped steam. Instruct your foundrymen to pour some of these castings in open molds and watch the iron as it rises. Then he can take the proper remedial steps on subsequent castings. Even in a quiet mold poured in open sand, a cleaner, solider casting may be secured by inserting a small rod in the metal immediately after it is poured and running it around the ring a few times. This will loosen any dirt clinging to the sides and will help any imprisoned bubbles to escape.

Armand Di Giulio

Dan M. Avey

F. A. Jensen

Men of Industry

Whose Activities Are Making Foundry History

DAN M. AVEY, re-elected president of the American Foundrymen's association at the Toronto convention, is editor of THE FOUNDRY, Cleveland. He is a graduate of the University of Illinois, and since 1917 he has been connected with the Penton Publishing Co., first with *Iron Trade Review*, and later with THE FOUNDRY.

For a number of years, Mr. Avey has been active in furthering the interests of various organizations affiliated with the foundry industry. He is a member of the American Foundrymen's association, the American Society for Testing Materials, the Institute of British Foundrymen, the Association Technique de Fonderie de France, and the International Association for Testing Materials. He has served 2 years as a director, one year as vice president and one year as president of the A.F.A. In addition he is past chairman of the International Relations committee and a member of several other committees.

W. A. MEDDICK has become connected with the C. O. Bartlett & Snow Co., Cleveland, in charge of the sale of mixers, air filters and accessory lines. Mr. Meddick formerly was manager of the industrial department, Lakewood Engineering Co., and later district representative for a group of manufacturers.

F. A. JENSEN, foundry consultant, recently has returned from the Soviet Union after having represented five American foundry equipment manufacturers there since the early part of 1933. Prior to that, Mr. Jensen was employed by the Soviet government as foundry consultant and projecting engineer from 1930 to 1933, during which time he was consulted on 84 new and rationalized foundry projects.

Previous to his Russian connections, Mr. Jensen was with the Sherman Engineering Corp., Toronto, Campbell Wyant & Cannon Foundry Co., Muskegon, Mich., and the Brown & Sharpe Mfg. Co., Providence, R. I. His present address is Elks club, Broad street, Newark, N. J.

F. P. Cox recently retired as manager of the West Lynn, Mass., works of the General Electric Co. He was associated with that company for 45 years.

NELSON J. DARLING, manager of the River works of the General Electric Co., at Lynn, has assumed management of both the West Lynn and the River works.

N. W. DUCHEMIN, formerly superintendent of the West Lynn works will be assistant manager in charge of operations at West Lynn. W. G. MITCHELL will continue as assistant manager in charge of operations at the River works.

ARMAND DI GIULIO, formerly assistant in the engineering research department, University of Michigan, Ann Arbor, Mich., recently became connected with the metallurgical research staff of the Ford Motor Co. Mr. Di Giulio was born in 1906 in Alfedena, Italy where he attended public schools. He was graduated from the Royal Technical institute in Terni, Italy, in 1924 and then attended the University of Michigan, where he received a bachelor of science degree in chemical engineering in 1930, a master of science in 1932 and a doctor of science in metallurgical engineering in 1935. While attending the university, he was assistant in the chemical engineering department for three years, and assistant in the engineering research department for five years.

Before coming to the United States, Mr. Di Giulio was employed in the

inspection department of the shipbuilding yards at Baia, Naples. During the summer of 1929 he was employed in the metallurgical and inspection departments, Wisconsin Steel Works, International Harvester Co., Chicago.

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MARTIN H. KIDDER has been appointed industrial relations director of the American Foundry Equipment Co., 555 Byrkit street, Mishawaka, Ind. Mr. Kidder formerly was connected with the Link-Belt Co., Boston Gear Works, and the Apollo Metal Works.

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J. H. BROWN, formerly eastern sales manager, Sullivan Machinery Co., has become connected with the Worthington Pump & Machinery Corp., as regional manager of its mining and construction division with headquarters in Chicago.

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HARRY E. BERGER has been named general purchasing agent, York Ice Machinery Corp., York, Pa., succeeding the late Earle Gardner. Mr. Berger started with the York company in 1903 as a stenographer and from 1906 to 1918 served in the sales department. Since 1918 he has been assistant purchasing agent.

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R. E. W. HARRISON, chief, machinery division, United States department of commerce, has resigned, effective Sept. 30, to resume consulting practice. Mr. Harrison will be associated with Eugene C. Clarke with offices at 1818 Packard building, Philadelphia. He will act as technical consultant for such concerns as the Chambersburg Engineering Co. and Cochrane Corp.

Mr. Harrison was appointed chief of the machinery division, bureau of foreign and domestic commerce, in April, 1934.

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JUDSON F. STONE, Chicago, formerly president, Belle City Malleable Iron Co., Racine, Wis., recently was made chairman of the board and C. S. ANDERSON, formerly vice president, secretary and general manager was elected president and secretary. J. M. STONE, formerly sales manager, was made vice president and assistant secretary, and S. KITTO, treasurer. All directors were re-elected.

The Racine Steel Castings Co., a subsidiary of the Belle City Malleable Iron Co., has elected the following officers: JUDSON F. STONE, president; C. S. ANDERSON, vice president, secretary and general manager; S. KITTO, treasurer and J. M. STONE, assistant secretary.

C. S. Anderson has been a resident of Racine all his life. After graduating from the local high school, he was connected with the cost department of the J. I. Case Threshing Machine Co., for 2 years, resigning to go with the Mitchell Wagon Co. Later he was transferred to the Mitchell Motor Car Co. in charge of the cost department, where he remained for 2½ years. He entered the employ of the Belle City Malleable Iron Co. in 1913 as secretary and treasurer, was elected general manager in 1922, and vice president and general manager in 1926.

Mr. J. M. Stone became connected with the Belle City company in 1923 after leaving Northwestern university. He was made sales manager in 1933.

New England Foundrymen's association held its August outing at the Chopmist Hill inn, North Scituate, R. I., Wednesday, Aug. 14.

Ohio Group To Hear Talk on Selling Castings

The first meeting of the fall season, Northeastern Ohio chapter of the American Foundrymen's association will be held at the Cleveland club, 10660 Carnegie avenue, Cleveland on Thursday evening, Sept. 19.

J. H. Redhead, president Lake City Malleable Co., Cleveland, will talk on "Merchandising Castings." A number of foundrymen, in Cleveland for the machine tool show, are expected to attend.

Organize Section Of A. F. A. in Canada

Canadian foundrymen, meeting in Toronto during the recent A.F.A. convention, formed an organization and decided to petition the American Foundrymen's association for a Canadian section of that organization. An organization committee is to be formed with two representatives each from the provinces of Ontario and Quebec, and one each from the remaining provinces of the Dominion.

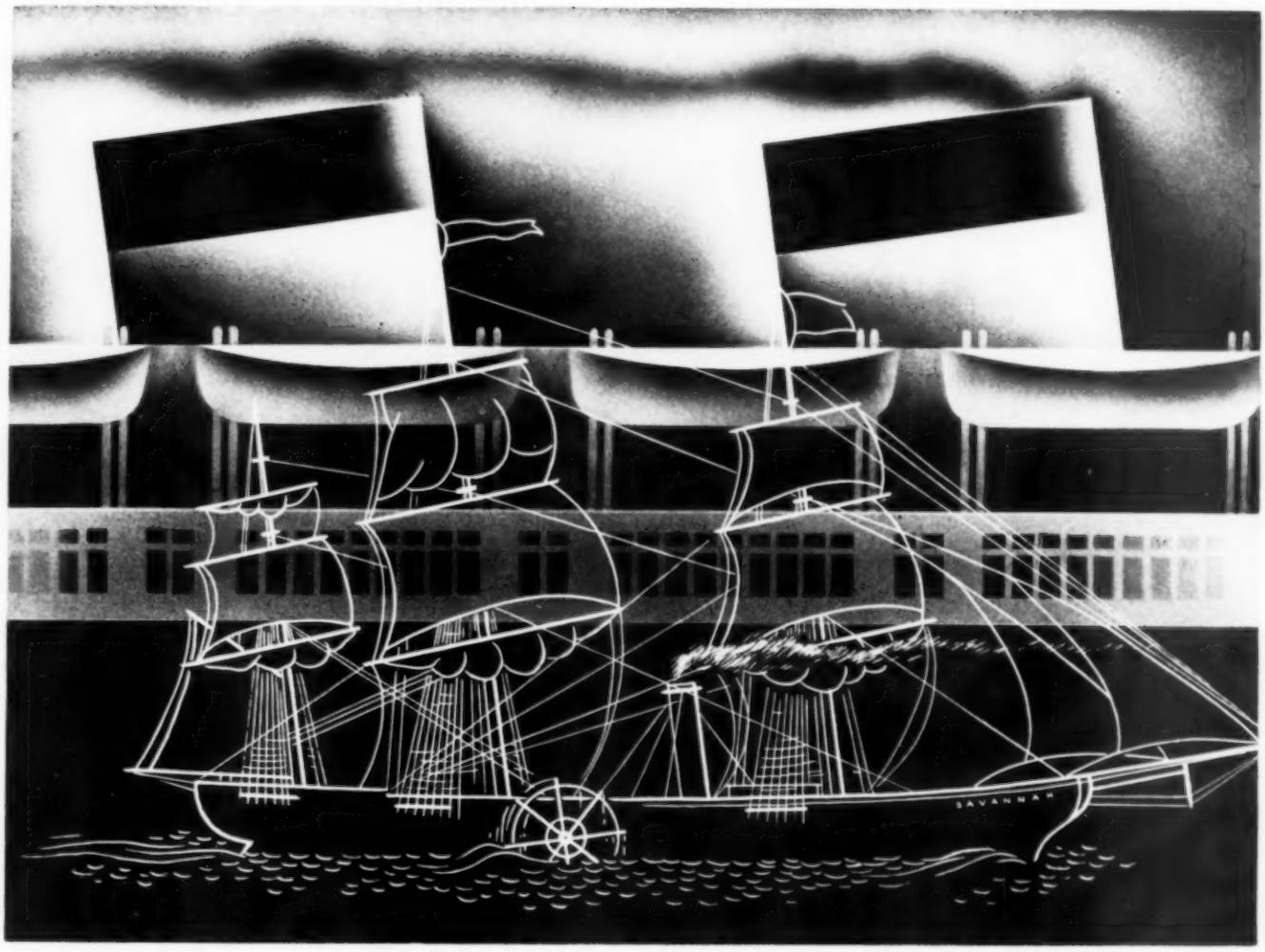
The following officers were chosen: Chairman, L. L. Anthes, Anthes Foundry Ltd., Toronto; vice chairman, H. J. Roast, Canadian Bronze Co. Ltd., Montreal; and secretary, John T. Hepburn, John T. Hepburn Ltd., Toronto.

Excellent progress in reducing accident rates in the nonferrous metals industry during 1934 is shown in a report recently issued by the National Safety council. The 1934 frequency rate is 8 per cent lower than that of 1933 and the severity rate is 27 per cent lower.

C. S. Anderson

Harry E. Berger

R. E. W. Harrison



Marvel of her era . . . outclassed today

When the Savannah made her epic crossing of the Atlantic she was hailed as the ultimate in steam-powered vessels. Yet such succeeding queens of the sea as the Great Eastern, the St. Louis and the Deutschland reigned under the similar popular belief that the limits of size, speed, luxury and safety in ocean liners had finally been reached. Today, even while the magnificent Normandie is ushering in another epoch in ocean transportation her alert owners are giving heed to the needs and problems the future may bring.

Steamship history has many parallels. Take steel. Since the basic discoveries of Kelly and Bessemer, steel progress has been restless with change . . . less visible, perhaps, than is possible with steamships, or skyscrapers, but gradual and pronounced nevertheless. The use of element after element has been developed to improve steel's qualities or to endow it with new properties for different purposes.

Many of such alloyed steels of the past two decades have come to be regarded as "satisfactory" for the uses they serve . . . mainly because engineers, superintendents and shop foremen have become accustomed to their characteristics. Yet change – progress – is still on the march. No advance of the past decade has been more significant than that afforded by Molybdenum. Widely proved during many years and in thousands of laboratory tests, and foundry, shop and service applications, this really unique alloying element has been found capable not only of improving practically all of steel's generally desired properties, but of enabling other alloys better to serve their particular purposes.

To engineers, metallurgists and production executives we offer these interesting books: "Molybdenum in 1934" and "Molybdenum in Cast Iron – 1934 Supplement." Also ask us to mail you our periodical news-sheet, "The Moly Matrix." Be free, too, to enlist our Detroit experimental laboratory's help at any time. Climax Molybdenum Co., 500 Fifth Ave., New York.

Visit the Climax exhibit in booths K-41 and L-42 at the National Metal Exposition, Chicago, Sept. 30-Oct. 4.

MOLY

CLIMAX Mo-lyb-den-um

INDUSTRY'S MOST MODERN AND VERSATILE ALLOY

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Co-operation

TO THE EDITORS:

I have kept your editorial appearing in the July issue of THE FOUNDRY on my desk and debated what I did think about co-operation. I must confess that I do not think the situation as regards co-operation in iron foundries or most other industries in a large way, looks hopeful. It seems men learn mostly by experience and that they will not believe in co-operative business principles sufficiently to practice them until they actually have experienced the failures that come from not practicing them or have inherited a so-called acumen for good business from the experience of their ancestors.

Likewise, there is that inherent spirit of selfishness and self preservation in people that fundamentally retards co-operation, so that until by a gradual growing experience we learn that co-operation pays, the progress is bound to be very slow.

This leads me to the conclusion that effective co-operation in most businesses that have many small units will not be possible for many years or generations to come. But, what we should do now is to attempt to teach through the experience coming from acquaintances with our competitors in associations and technical groups and by demonstrations of co-operative experiences in small ways, that co-operation pays and should be practiced in larger ways.

However, we are made independent, free, thinking, human beings. We think we can run our own business. New leaders are constantly being developed so that the question is —who is the leader to follow? In a business like ours, where at least 30 per cent of us are going to be eliminated during the next few years, one wonders if he will not have to be among the rugged individualists who cling to good business ethics and principles but who, on the other hand, fights single handed if he is to be among the survivors.

This problem of co-operation and following the big business leader is a many-sided problem in the gray iron casting business as I see it.

But, here is a new thought. Why not start educating the buyer and those who are their superiors and can dictate policies, that sharp buying practices carried to the point of beating people down to losing prices acts like a boomerang to business itself. Factories and businesses which do not make money cannot buy. Plants are not kept in repair. New improvements are not made. New engineering developments can not be financed. When these are considered, they constitute the margin between prosperity and depression. Consumptive purchases will remain good if these other items keep going.

Personally, I think modern purchasing technic is responsible for most of our depression. One of the most necessary things to do to create and maintain prosperity is to create a code of honor among leaders of business and their purchasing departments whereby they will buy as cheaply as they can but at the same time will give orders only to those whom they feel sure will make a profit at the purchase price. In other words when business men and purchasers realize that all must make a profit in order for they themselves to maintain a profitable business, then business will be on a sound basis.

In other words, I think the producers need education but I also believe it is more important to educate the buyer in order to have prosperity. We are all buyers.

A. C. DENISON,
President
Fulton Foundry & Machine Co., Inc. Cleveland.

Assisting the Leaders

TO THE EDITORS:

The editorial "Leaders Call for Followers" appearing in the July issue of THE FOUNDRY, emphasizes a very important point in connection with the progress of the foundry industry. Success depends upon leadership. In a far-flung industry the man at the head cannot possibly see all and know all; he must have enthusiastic and able lieutenants scattered throughout the various parts of the country. If these men in turn are leaders they will create interest in the industry's problems and obtain the backing of at least a substantial majority of the industry

Even with such a group of men leading the industry success is not assured unless the general interest has been aroused. Every member must be made to realize that his actions not only affect the results of his company but also, either directly or indirectly, influence the progress of the industry as a whole. He therefore must be kept advised of what is going on in the industry and, in turn, he must keep the leaders advised of what he is doing and what he thinks the other members of the industry, as a whole, should do.

Industry cannot expect some magician to simply wave the wand and in this way cure all of the ills; on the contrary, success can only come first, through leadership, second through organization, and finally, through the interest and loyal devotion of each and every member of the industry to the problems of the industry, which, after all, are the problems of the individual.

Some of the members of industry do not seem to appreciate that the leaders of their national trade association are not trying to tell them what they should or should not do but, on the contrary, are simply carrying out the wishes of those members of the industry who have seen fit to express themselves. In other words, criticism that does not reach the industry leaders produces no beneficial results; whereas, the same criticism, if directed to those that are wrestling with the industry's problems, will either materially assist these leaders in their work or give them an opportunity to show the critic wherein he is in error. California could not have beaten Cornell at Poughkeepsie unless its entire crew had pulled together from the start to the finish.

H. M. HALSTED JR.
Executive Vice President
Gray Iron Founders' Society, Inc. Cleveland

European Practice

TO THE EDITORS:

Returning from a trip to Germany and Sweden, where I have visited several brass foundries, I am writing down some of my observations in the hope that they may be of interest to your readers.

The average brass foundry over there—even large ones—melt only red brass, yellow brass and aluminum alloys. They leave the manganese and aluminum bronzes and other tricky alloys to specialists, and they do not put aluminum in yellow brass. One owner of a large brass foundry in Sweden states that he added one per cent manganese in yellow brass and that this makes the metal more fluid.

Pyrometers generally are used and all foundrymen agreed upon the importance of not overheating aluminum alloys. Much attention is paid to the importance of gating aluminum alloy castings so that they can be poured at low temperatures.

One foundry with a yearly produc-

(*Continued on page* 50)

Proof of Advertisement from THE FOUNDRY, Cleveland
August 1935

August 1935

Announcing the
SCHNEIBLE MULTI-WASH
WET COLLECTOR for
SUPPRESSING DUST
—in general atmosphere
—at the SHAKE-OUT
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and others in course of construction and installation.

Schneible Multi-Wash Dust Collectors are highly efficient—have a constant back pressure—have no moving or rapidly wearing parts—require a minimum of maintenance—and are available in sizes to cope with every dust suppression problem.

Eliminate your dust hazard—investigate the Schneible Method of dust suppression

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. . . . In less than thirty days **three users** of Schneible Multi-Wash Dust Collectors have **purchased twelve more units—**
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. . . Send for a copy of this new Bulletin! It contains a complete description of the Schneible Multi-Wash Dust Collector, Multi-Louver Dewatering Tank and "Wear-Proof" Pump as well as data on five recent foundry installations employing the Schneible Multi-Wash Dust Collecting Method! *Write for your copy today.*

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4755 N. Crawford Avenue, Chicago

The biggest problem in foundry operation today is the elimination of the dust hazard!

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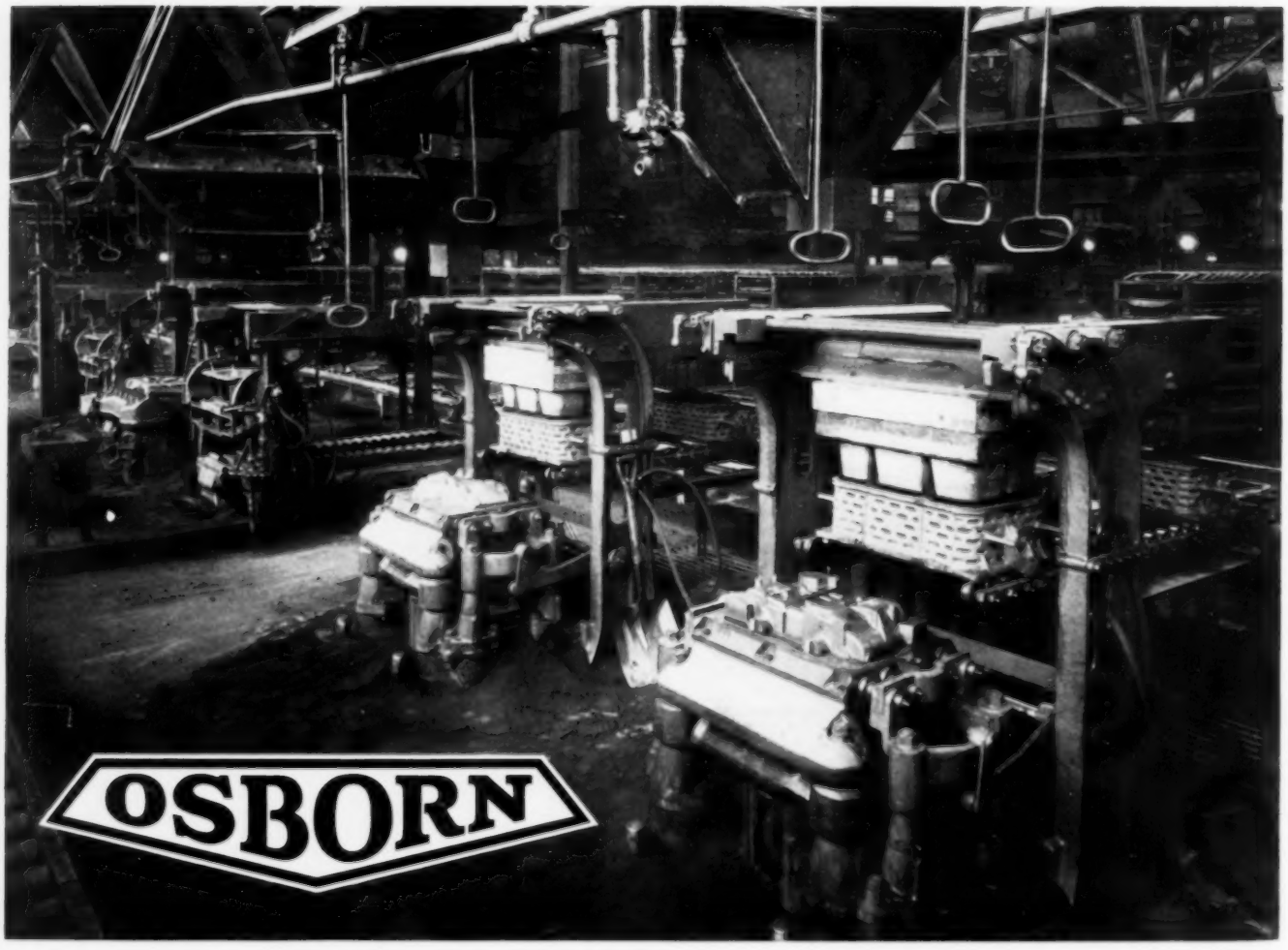
A Combination

HIGHEST SPEED PRODUCTION

LOWEST MOULDING COST

Accomplishment of these four vital factors is made possible by the outstanding performance of the Nos. 816 and 818 Osborn Jolt Squeeze Stripper Moulding Machines with Flask Roll-Out.



# of Vital Factors!

HIGHEST QUALITY MOULDS

LOWEST POSSIBLE SCRAP LOSS

Batteries of these high speed Osborn Jolt Squeeze Strippers are now in operation in the Buick foundry at Flint, Michigan. Illustrated are partial views of one battery of machines.

95 TO 110 MOULDS PER HOUR

Average Production Per Machine

One battery of Osborn Jolt Squeeze Strippers are producing transmission cases (as illustrated on opposite page). A close-up view of one of these machines is illustrated at right.

Other batteries are producing manifolds and clutch housings. Where Jolt Squeeze Strippers produce clutch housings, they are operated with No. 332 Jolt Rollover Squeeze Pattern Draw Moulding Machine (with special squeeze head) to make and draw green sand cores on drag moulds.

Note to Foundrymen

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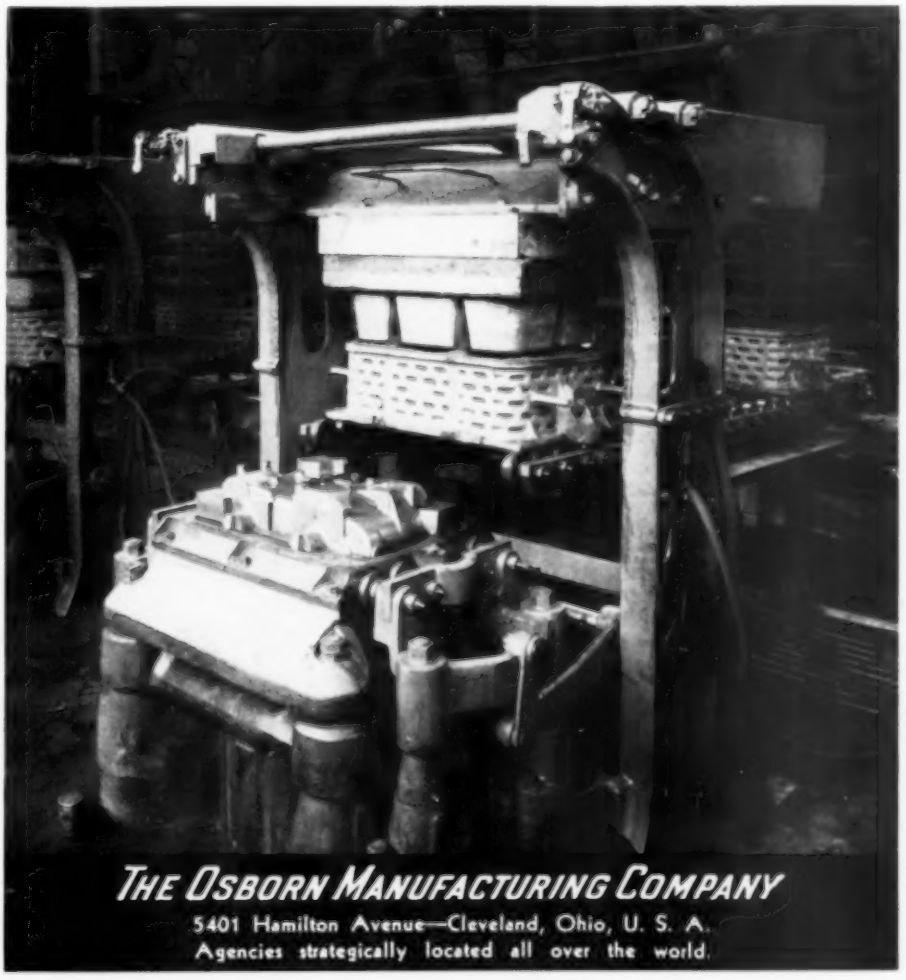
Whatever your requirements may be, it is to your interest to investigate the up-to-date line of Osborn Moulding Machines and Auxiliary Equipment.



THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue—Cleveland, Ohio, U. S. A.

Agencies strategically located all over the world.

(*Continued from page 46*)

tion of about 50 tons of red brass and 40 tons of aluminum castings has made a tensile test machine at a cost of about $600 which is used for pulling test bars.

Foundrymen take great care not to mix molding sand for aluminum castings with sand for red brass. This is a good practice and I know it also is followed in American brass foundries.

The European brass foundries use scrap to a much greater extent than the American. This is due in the first place to the part that over there they use equipments and installations much longer than we do before scrapping. Therefore scrap from aluminum bronzes and others, that contaminate red brass, is rare. In the second place they do not have as many different alloys as we do and the scrap therefore is more uniform.

Foundry operations are as a rule not as highly mechanized as ours, but rate of production also is correspondingly lower.

Everything taken into consideration, I believe that a European brass foundryman can learn more in the United States than an American in Europe. One thing the latter can learn, if he doesn't know it before, is that haste often makes waste.

JAMES BRINN

L. A. Cohn & Bro. Inc.
Chicago.

Full Support

TO THE EDITORS:

Your editorial in the July issue was very timely and appropriate. Foundrymen should co-operate for the common good of the entire industry. I believe most foundrymen will say *yes* to your suggested pledge of treating their employes fairly, recognizing standard cost practices, refrain from price cutting, manufacture sound merchandise and last but not least follow the industry's fair trade practices as outlined by the Gray Iron society. You can depend on our pledge to support your program and co-operate 100 per cent.

WILLIAM T. MELLOW
Vice President

Liberty Foundry Co.
St. Louis

Well Received

TO THE EDITORS:

As foundry instructor at Rhode Island State college, Kingston, R. I., I have been using THE FOUNDRY in past years, posting interesting articles for my students to read. All of these articles have been well received and well read, the only disadvantage being that it rather spoils my file of back issues for future reference use.

W. D. ARCHIBALD,
Instructor in Shops

Rhode Island State College,
Kingston, R. I.

History Repeats

TO THE EDITORS:

"We have with us the new foundry." Great stuff and it is good because every statement rings the bell. It certainly is a sharpshooters 100 per cent record.

After reading it I was reminded of

our strong claim of 22 years ago, and under separate cover have mailed you a front cover of THE FOUNDRY, November issue.

History repeats itself and at the moment I believe it will again, although perhaps not for ten or 20 years, but it will as sure as fate.

Keep up the good work.

DAVID MCLAIN

McLain's System, Inc.
Goldsmith Building
Milwaukee

(Editor's note: The front cover referred to is reproduced in the accompanying illustration. Incidentally, we believe Mr. McLain is celebrating his seventy-second birthday on Nov. 11 and we know he will be happy to hear from all of his old students)

Lists Federal Offices

Bureau of foreign and domestic commerce, department of commerce, Washington, recently has prepared an unofficial list of purchasing offices of the federal government which includes not only the main offices in Washington, but also the field purchasing agencies throughout the United States. The publication may be secured free from the machinery division, bureau of foreign and domestic commerce, Washington.

Purchases Company

Carborundum Co., Niagara Falls, N. Y., has purchased the assets and good will of the Hutto Engineering Co., Detroit, manufacturer of cylinder honing and grinding machines. Operations of the Hutto company will be expanded as a new division of the Carborundum Co.

Equipment Makers Hold Meeting in Toronto

Three interesting addresses dealing with problems of prime importance to industry today featured the dinner meeting of the Foundry Equipment Manufacturers' association held in Toronto during the A.F.A. convention. F. R. Wallace, president, Tabor Mfg. Co., Philadelphia, and president of the association presided.

Frank Connolly, assistant to the director of industries, Federal housing administration, speaking on "How the Federal Housing Administration Can Help You Sell Foundry Equipment", discussed the provisions of the act as applied to the purchase of equipment. Loans up to $50,000 may be secured through local banks with the administration guaranteeing against loss up to 20 per cent. The speaker pointed out that the borrower benefits in that money is available at a low rate and that it is paid back in easy monthly payments. No down payment is required and the first payment is not due until after 60 days. The seller benefits in that a cash transaction is possible.

An interesting discussion of governmental regulation and its effect on industry was presented by Thomas W. Pangborn, president, Pangborn Corp., Hagerstown, Md. In introducing the subject of his talk, Mr. Pangborn stated that in his opinion the application of sound business principles to the business of government would dissipate much of the difficulty growing out of the complicated superstructure of public officialdom. The speaker discussed a number of bills, some already passed and others pending, which in his estimation seem to carry regulation to extinction of business. In closing, Mr. Pangborn stated that more than at any other time in recent years, the country today needs political leadership.

The final speaker, Samuel John Frame, secretary, Metal exchange, Toronto, discussed "Co-operation in Industry". Mr. Frame stated that in Canada the regulation of prices is an important function of trade association work, and in his opinion that feature has been an important factor in the relative businesss situation which Canadian industry has enjoyed during the depression years. The speaker stressed the great value of trade association effort in the United States at this particular time.

A business meeting of the association followed the formal program and dinner.

Detroit Foundrymen's association held its third golf tournament of the season on Thursday, Aug. 15 at the Brooklands golf and country club.

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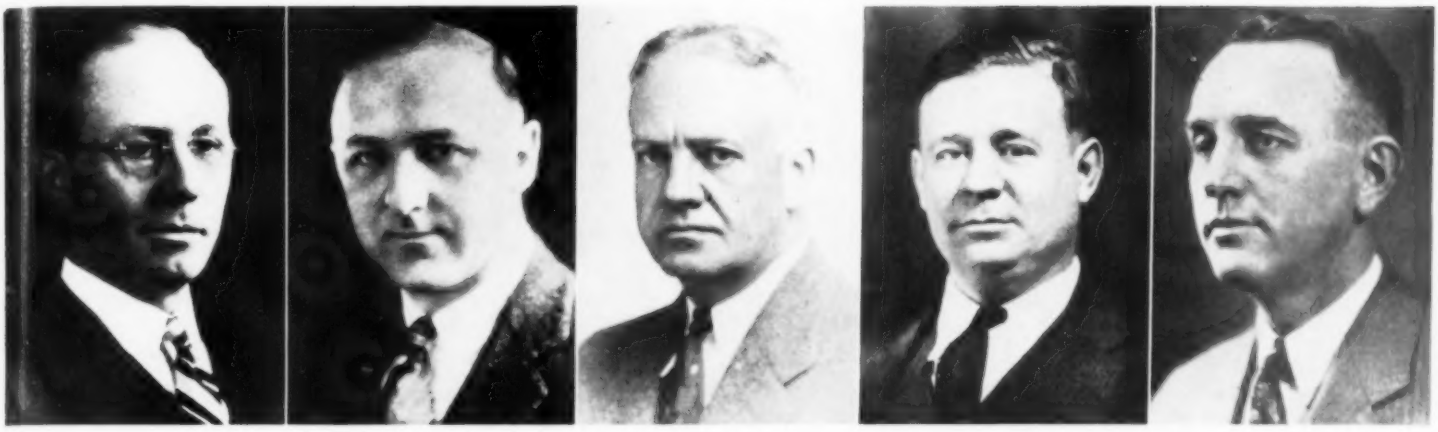


W. H. J. Cluff | L. S. Peregoy | H. S. Washburn | C. E. Davis | F. A. Sherman

Meet the New A. F. A. Directors

RESULTS of the annual election of the American Foundrymen's association, announced at the business meeting during the recent Toronto convention, introduced five new men into the more intensive work of the association. Personalities who will be devoting greater time and services to carrying on the ideals of the A. F. A. during the next 3 years include the following five new directors: W. H. J. Cluff, C. E. Davis, L. S. Peregoy, F. A. Sherman and H. S. Washburn.

W. H. J. Cluff

W. H. Joseph Cluff was born at Listowel, Ontario, in 1883, and received his education in the schools of Detroit and the Detroit Business university. In 1901 he entered Frederic B. Stevens Inc., Detroit, one of the oldest foundry supply houses in the country. By his energy and effective work, Mr. Cluff has risen from his first position as office boy to the presidency of the company.

The Detroit Foundrymen's association has claimed the services of Mr. Cluff for the past 25 years.

C. E. Davis

C. E. DAVIS was born at Kalamazoo, Mich., in 1893, receiving his early education in the schools of Peru, Ind. Finishing an apprenticeship with the Modle Engine Co., Peru, in 1914, he became a tool supervisor at the Pittsburgh branch. He served as district sales manager of the W. L. Brubaker & Bros. Co., Millersburg, Pa., from 1922 to 1927, following which he became general superintendent of the Homestead Valve Co., Coraopolis, Pa. In the spring of this year Mr. Davis accepted the vice presidency of the Alloys Specialty Co., Coraopolis, a firm organized in 1934 to make alloy iron castings. He also is the efficiency engineer for Russell, Burdsall & Ward Co., Coraopolis.

Mr. Davis is a past president of the Pittsburgh Foundrymen's association.

L. S. Peregoy

LAMAR S. PEREGOY was born at Davenport, Iowa. He was educated in the schools of Milwaukee, the city which subsequently has become his home and the center of his business activities. From 1905 to 1909 he was affiliated with Northwestern Malleable Iron Co. following which he held various executive and managerial positions in the Sivyer Steel Casting Co., before assuming his duties as president.

Mr. Peregoy has been active in the direction of the Electric Steel Founders' Research group, the Steel Founders' society and the National Founders' association.

Frank A. Sherman

FRANK A. Sherman, now a citizen of Canada, was born in Crown Point, N. Y., in 1887, obtaining his early education in Chicago. He began his industrial experience in the Pennsylvania Malleable Co., Pittsburgh, in 1906. The following two years he served the Mesta Machine Co., Homestead, Pa., and the Fort Pitt Malleable Iron Co., Pittsburgh, as chemist. In 1908 he was foreman for the Pratt & Letchworth Co. and four years later was transferred to its Brantford, Ontario plant. Starting as foreman of the Dominion Foundries and Steel Ltd., he rose to his present position as general manager of the company.

Henry S. Washburn

HENRY S. WASHBURN was born in Brooklyn, N. Y., being educated at St. Paul's school, Garden City, N. Y., and Yale university. He began his commercial work as bookkeeper with the Corn Exchange Bank of New York. From 1906 to 1917 he filled various positions as clerk, credit man, and office manager of the D. L. & W. R. R., H. B. Claflin Co. and Butler Bros., New York. The intervening years before he became president and treasurer of the Plainville Casting Co., Plainville, Conn., were spent as purchasing agent for Turner & Seymour, Torrington, Conn.

He is a member of the Connecticut Foundrymen's association, National Founders' association and Gray Iron Founders' society.

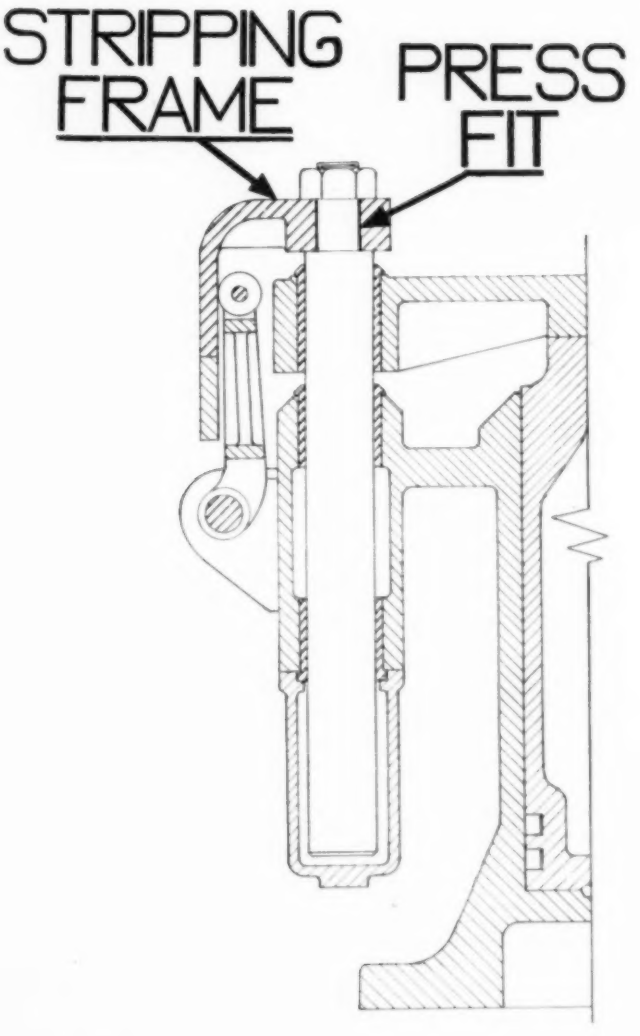
Detroit in 1936

ON ACTION of the board of directors of the American Foundrymen's association at the meeting held Aug. 23, Detroit was designated for the fortieth annual convention to be held during the week of May 4, 1936. An exhibition of foundry equipment and supplies will be held in the Convention Hall, a short distance from the downtown section.

The invitation of the City of Detroit, through its convention organization, was supported by the foundry interests of that city. The last previous foundry convention with an exhibition held in the Motor City was in 1926 in connection with the second International Foundrymen's Congress.

FLOATERS
Are DEAD

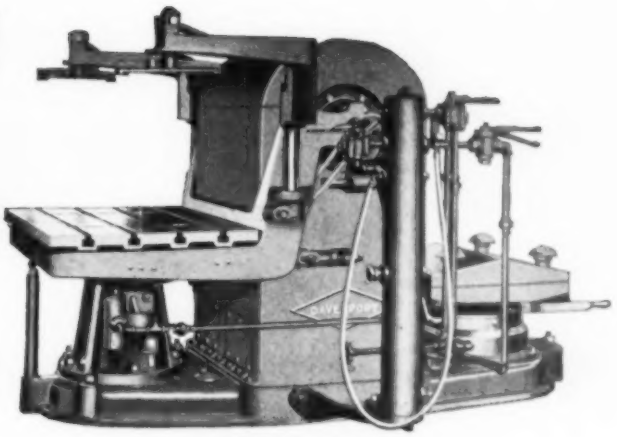
It is not necessary for customers to furnish guide pins in pattern equipment when using Milwaukee machines, as our pins are a press fit in the stripping frame and do not permit the stripping frame to float—exclusively Milwaukee.



No. 142 Milwaukee

Two fitting guide pins are worth more than a dozen floating pins. Stripping plate wear is negligible when using Milwaukee machines.

MORE THAN 75 TYPES *and* SIZES TO SELECT FROM



No. 28

We can furnish a DAVENPORT
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MILWAUKEE MOLDING MACHINE
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Let us quote on Equipment that is built to serve

A Core Grinder
that saves

70" Diameter Table

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MILWAUKEE FOUNDRY EQUIPMENT CO.

3238 West Pierce Street
MILWAUKEE, WISCONSIN

A.F.A. Reviews Foundry Progress

(*Continued from page* 25)

tional records, determination of the nature and concentration of the dust suspended in the working atmosphere, analysis of the mortality records in the district, and if possible, post-mortem examinations of old employes dying from any cause. In the discussion which followed, Mr. Cummings emphasized again the importance of the physical examination of new employes and the examination of all workmen at regular intervals, as best determined through practice and study.

In discussing the subject of plant housekeeping, a number of those present told of some of the steps taken in their plants to provide greater safety and health to employes. E. O. Jones, National Founders' association, Chicago, discussed pending legislation in several states, and pointed to some of the simple things which can be done in many plants to provide greater safety for workmen, also increasing efficiency.

Officers of four established chapters of A. F. A. and representatives of several local associations met Wednesday morning to discuss common problems relating to the various chapter activities. The discussion developed numerous suggestions in relation to programs, membership activities, financing, social affairs, etc. Reports were made by James Thomson, chairman of the Chicago chapter, Frank G. Steinebach, vice chairman of the Northeastern Ohio chapter, A. E. Hageboeck, chairman of the Quad Cities chapter and Carl Dodge, vice chairman of the Philadelphia Metropolitan district chapter. Talks were made by C. E. Hoyt, executive secretary, Robert E. Kennedy, technical secretary, H. S. Simpson, National Engineering Co., Chicago, who recently visited the Pacific coast and discussed chapter activities in Los Angeles, San Francisco and Seattle. President Dan M. Avey presided.

Consider Malleable Problems

THE first session on malleable cast iron was opened Wednesday morning with R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., in the chair. He called upon E. G. Mahin, University of Notre Dame, South Bend, Ind., to present a paper written in collaboration with J. W. Hamilton, Bendix Products Corp., South Bend, on endurance limit of black-heart malleable. Results obtained indicate that the endurance limit of the iron examined was slightly above 30,500 pounds per square inch, which is considerably higher than shown in previously reported data. Mention was made in the paper that the rounded projections on the temper carbon in the specimens reduced stress concentrations. A. Di Giulio, Ford Motor Co., Ann Arbor, Mich., said that that form would be dependent upon silicon content and heat treatment. H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland stated that perhaps the notch effect as depicted by the temper carbon was not so important, and that the lower Young's modulus of elasticity may indicate lower stress concentration.

The second paper, prepared by F. B. Riggan, Stockham Pipe & Fittings Co., Birmingham, Ala., on production of cupola malleable iron, was presented by H. C. Aufderhaar, Electro Metallurgical Co., Chicago. Average tensile strength of that material, according to the author, was 48,000 pounds per square inch; yield point, 34,000 pounds per square inch, and elongation 9 per cent. Following the paper, H. A. Schwartz presented the report of the committee on specifications which pointed out that due to conflicting opinions of members of committee A-7 of the A.S.T.M., little progress has been made in preparing specifications for cupola malleable iron for pipe fittings.

Discussion at the malleable round table on Thursday afternoon developed the fact that the market for special or pearlitic malleable irons has as yet only been scratched. That class of irons provides a means for the malleable foundryman to increase the market for his products by replacing articles made by other means of fabrication, especially forging, with castings. The fact that the irons may be produced in a wide range of both strength and ductility provides an exceptionally good sales point. In this connection, it was pointed out that a large automobile manufacturer has established a definite policy of using castings in place of forgings wherever possible.

Life of Furnace Bottom

In a discussion of the advantages and disadvantages of brick bottoms, one foundryman stated that he has a furnace using a brick bottom, that he has obtained between 75 and 80 heats and that the bottom still has the appearance of being in good condition. He has found that it is necessary to allow 1 to 1½ hours longer on the first heat when the furnace is stone cold than is necessary on other heats. This does not apply over week ends when it would seem the bottoms retain sufficient heat to permit melting within the regular period of time. Another company using a brick bottom reported securing 150 heats.

Considerable time was devoted to a discussion of the rotary powdered coal furnace in the production of malleable iron. Heating the metal from both top and bottom is the important feature of design of the furnace. It was stated that the efficiency of the furnace is from three to four times greater than the stationary type air furnace. It was pointed out that the furnace does not require skimming.

(*Continued on page* 59)

J. L. Wick Jr.

V. A. Crosby

R. G. McElwee

John Howe Hall

H. L. Campbell

ADVERTISING PAGES REMOVED

Neil I. McArthur | Hy Bornstein | J. T. McKenzie | E. W. Campion | J. E. Hurst

(*Continued from page* 56)

Iron is stirred automatically as the furnace turns and tapping is exceedingly simple with three tap holes provided to prevent excessive wear at any one point in the lining while the furnace is being tapped. Best results were said to have been obtained with a silica brick lining. Operating one shift with three heats a day, it was stated a lining of silica brick should give approximately three months' service without a great amount of maintenance. Best results have been obtained with direct firing units.

In considering continuous pouring, the statement was made that it is profitable to pour continuously where 40 tons or more of iron is melted per day. In discussion annealing cycles, one operator stated he is operating a 25-ton electric furnace on a 72-hour cycle. In that furnace the castings are heated up at night to keep down the demand charge. With a regular fuel fired furnace, four cycles are completed a month, while three are obtained in a muffle type unit. Considerable time was devoted to discussion of various points in the annealing cycle.

Nonferrous Subjects Considered

THE first nonferrous session which convened Thursday morning, constituted the third annual conference on deoxidation and degasification of nonferrous metals. The meeting was under the direction of Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa. with E. F. Hess, Ohio Injector Co., Wadsworth, O., acting as vice chairman. R. J. Keeley, Ajax Metal Co., Philadelphia presented a paper on deoxidation and degasification of nickel-silver alloys, stating that due to the wide range of compositions under the classification of nickel-silvers, problems of deoxidation and degasification were sometimes difficult to solve.

Deoxidizing Agents

To present a clearer picture, Mr. Keeley gave data on a number of alloys regarding composition, melting practice, troubles encountered, and the changes which brought about favorable results. In summarizing he said that in sand cast nickel silvers for pressure work which contained under 3 per cent lead, addition of silicon up to 0.25 per cent served as a deoxidizer and degasifier. With lead over 3 per cent, 0.10 per cent manganese and 0.05 per cent magnesium should be used. For work not intended to withstand pressure, aluminum served as a deoxidizer and degasifier.

In discussing the paper, T. E. Kihlgren, International Nickel Co., New York, called attention to the fact that changes in composition also caused change in melting point, fluidity, etc., and that with higher melting temperatures, better feeding of the castings was required. He said that he differed with Mr. Keeley in that he did not believe it was advisable to use silicon in nickel silvers containing lead. Sam Tour, Lucius Pitkin Inc., New York, stated that he doubted whether the addition of small amounts of silicon would increase shrinkage of nickel-silver, and attributed increase in shrinkage to removal of occluded gases.

The second paper on the program was that entitled, "Modifying Phenomenon and Its Probable Relation to Properties of Nonferrous Alloys," by C. H. Lorig and R. W. Dayton, Battelle Memorial institute, Columbus, O., which was presented by Mr. Lorig. This suggested that changes in grain size, etc., might be due to submicroscopic particles which acted as nuclei for crystallization. With a large number of nuclei the tendency would be toward small crystals while large crystal size would result with fewer particles. If that were the case, study would develop means to control the size and number of particles, and consequently the crystal or grain size of the alloy.

O. W. Ellis, Ontario Research foundation, Toronto, said that the nuclei or slag cloud hypothesis offered by the authors of the paper seemed reasonable, and that it was quite possible that the cloud under certain conditions would go into solution or come out. Dr. G. H. Clamer, Ajax Metal Co., Philadelphia, mentioned briefly a gyratory process used in France for improving cast iron which might be applicable to nonferrous alloys. Essentially the process consists in placing the molten metal in a ladle which is rotated on a vertical axis. The centrifugal action causes the lighter impurities to move to the center or quiescent portion of the bath where they coalesce and can be removed. E. G. Mahin, University of Notre Dame, South Bend, Ind., and Sam Tour also discussed the paper.

Committee Activities

Mr. Strauss then presented a brief report of the various activities of the the committee which arranged the nonferrous division including that of nonferrous section of the *Cast Metals Handbook*, the recommended practice committee which prepared a paper on that phase for the common aluminum-copper alloys, and the committee on recommended procedure for the analysis of defects. He called on William Romanoff, H. Kramer & Co., Chicago, to present the report of the latter committee describing its work so far which outlines the various types of defects that may be encountered.

Problems related to the production of sound castings was the topic of discussion at the roundtable nonferrous luncheon held Thursday under the direction of H. J. Roast, Canadian Bronze Co., Ltd., Montreal. To provide a clearer picture specific examples were shown by lantern slides and by castings, before and after the troubles from porosity, inclusions, etc. were remedied. One was an aluminum alloy casting containing 4 per cent copper which

originally had a single sprue, double branch gate and two risers close to the casting. The casting weighed about 3 pounds, and the section in general was thin adjoining a heavy section. Trouble from porosity, inclusions, cracking, etc. was overcome by using two double branch gates, and numerous risers at various points.

Another was a 400 pound casting made in silicon bronze which by usual gating methods showed shrinkage in the central heavy portion. By using a riser 10 inches in diameter and 19 inches high a solid, sound casting was obtained. In that instance the riser weighed as much as the casting, and it was pointed out that feeding of the casting in any case is dependent upon volume of molten metal available rather than the pressure induced by height of riser. It was mentioned that the same casting was made from other bronze alloys by regular practice without need for such a large riser.

Determine by Experiment

Consideration was given to pouring temperature, and it was stated that for every casting there was a definite critical temperature which could be determined by experiment. Consequently, it is advisable in all cases to locate the best pouring temperature, and see that the metal is poured at that temperature.

In another case of a red brass casting difficulty was encountered in obtaining sound castings due to the fact that it was gated through a thin flange. Changing the gate to the heaviest section corrected the difficulty.

James L. Wick, Jr., Falcon Bronze Co., Youngstown, O., presided over the final session on nonferrous metals, and called upon Dr. J. A. Gann, Dow Chemical Co., Midland, Mich., to present a paper written in collaboration with M. E. Brooks of the same firm. The paper entitled "Founding of Magnesium Alloys," gave an interesting and detailed account of all the phases involved. Dr. Gann said that a flux composed of 60 per cent anhydrous magnesium chloride and 40 per cent sodium chloride was found to be most suitable for melting the various alloys. Due to the chemical activity of molten magnesium, it was necessary to mix the molding sand with sulphur, boric acid or ammonium fluoride and temper with ethylene glycol with some water.

Open molding sand with a permeability from 50 to 60 gave good results. Face of the mold is kept soft by soft ramming at that point, and the mold must be vented freely. Entry of metal into the mold cavity preferably should be low, and use of perforated steel skim screens has been found to give excellent results in obtaining clean castings. Due to the lightness of the metal, and its shrinkage factors of 3/16-inch for average and 5/32-inch for heavy sections, gates and risers must be generous. Use of a large number of finger gates gives the best results.

Cores used in magnesium castings usually employ oil binders, and they are made soft so as to permit easy crushing. After drying they are coated with an alcohol-graphite wash which is ignited; the alcohol volatilizing and burning, leaving the graphite deposited. In some cases with pressure castings, it is found necessary to impregnate them with china wood oil which is polymerized or hardened in place by immersing in an engine oil bath at 250 degrees Fahr. Then the oil on the surface is removed with kerosene.

Following the presentation of that paper, Mr. Wick called upon Sam Tour to give the salient points of A. J. Murphy's paper entitled, "High Strength Nonferrous Casting Alloys," which was submitted in behalf of the Institute of British Foundrymen. The author is associated with J. Stone & Co. Ltd., Deptford, London, and in his paper described properties and characteristics of various high strength alloys such as manganese bronze, aluminum bronze, silicon-monel metal, zinc-base and aluminum-base alloys, and magnesium base alloys. With each type of alloy the author endeavored to show in outline the fields in engineering practice to which it was best suited. In addition he stated that in practically all cases the full advantages of the special alloy result from unremitting care and often special technique in the foundry.

Cost Committee Studies Policy

CHARTS of cost systems as now exist for the nonferrous, gray iron and malleable industries were displayed and discussed at length at the open meeting of the foundry cost committee held Wednesday morning. Sam Tour, Lucius Pitkin Inc., New York, served as chairman.

In commenting on what the cost committee can do to promote cost systems and methods of procedure, Robert E. Belt, secretary, Malleable Iron Research institute, Cleveland, stressed the dissimilarity in the three charts displayed. In the four branches of the foundry industry, he stated, we have the same departmental breakdown of costs. The smallest number exists in the gray iron industry and the greatest number in the malleable iron industry. All start with metal and include such items as molding, melting, cleaning, finishing, shipping and general administration expense. The malleable iron industry, he pointed out, is now applying the greater portion of the expense of the cost items on the rate of metal poured because of the low yield.

Uniform Cost System

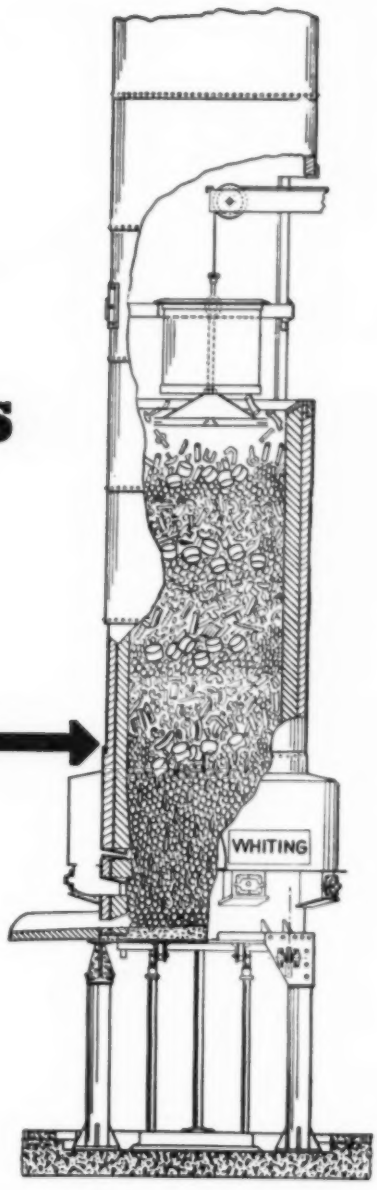
Henry Halsted, executive vice president, Gray Iron Foundry society, Cleveland, questioned the possibility of arriving at a uniform cost system for the four branches of the industry, because of certain customs which exist.

At the time the charts were prepared, stated P. E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O., the idea merely was to incorporate the general subdivisions, many of

(*Continued on page* 62)

D. J. Reese | H. W. Dietert | O. W. Ellis | George F. Pettinos | Fred J. Walls

Briquetted Alloys reach their objective



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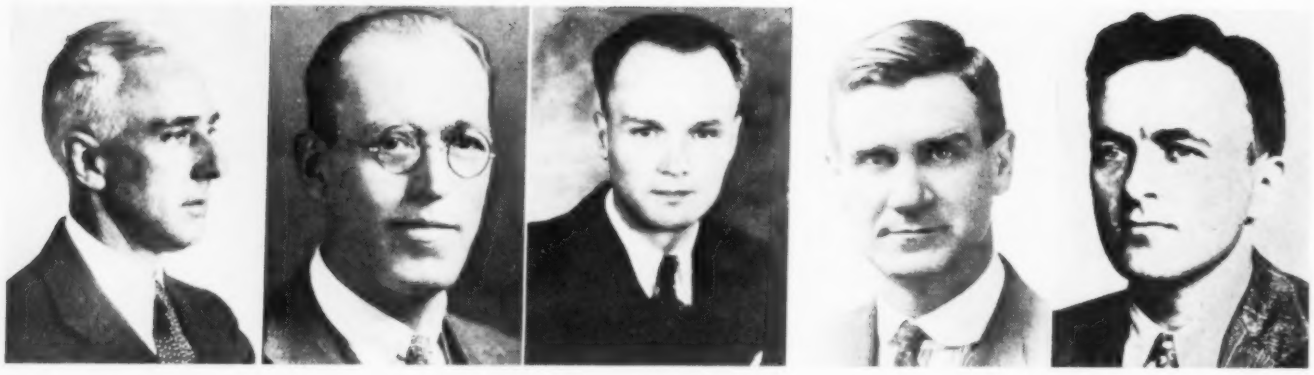

J. E. Goss | George Batty | Garnet Phillips | John Grennan | E. J. Ash

(*Continued from page 60*)

the details having been left out to avoid complicated charts.

Mr. Belt stated there is already a similarity in the departmental cost breakdown, and if the four branches were to decide on a few fundamentals as applied to the costs there would be a tendency toward uniformity. He suggested that the cost committee center its attention on the analysis of the four cost systems aiming toward uniformity and at the same time concentrate on the nonuniform practices, ever keeping in mind the idea of making them uniform.

Mr. Tour stated the committee does not propose to formulate a uniform cost system for the entire industry nor does it propose to criticize the cost systems and thereby hamper their use. The work of the committee, he emphasized, is to help the trade associations to work up the various cost systems.

At present, Mr. Tour related that the committee for each of the four industries is composed of one man and a chairman. He stated that this could be enlarged to include two men from each industry and a chairman.

C. S. Anderson, Belle City Malleable Iron Co., Racine, Wis., suggested that the additional member be an accountant to enable the committee to secure the greatest amount of help. That each trade association should appoint the second member of the committee from its own ranks was the opinion voiced by Mr. Rentschler.

The general conclusion following the two-hour discussion was that the cost systems in their present form should be submitted to the respective industries and recommended for use until such a time as changes became necessary. Any criticism should be referred to the trade association committee responsible for the cost system in question and not to the industry as a whole and thus publicized.

Cast Iron Discussions Varied

EXCELLENT attendance marked the opening session on cast iron held Tuesday morning following the opening meeting. Hyman Bornstein, Deere & Co., Moline, Ill., presided as chairman with V. A. Crosby, Climax Molybdenum Co., Detroit, as vice-chairman. The first paper was that of Garnet P. Phillips, International Harvester Co., Chicago, which described results obtained from impact resistance tests on alloy cast irons made in the cupola and in the electric furnace. Those indicated that in the case of irons cast gray, fairly high carbon nickel-molybdenum that may contain chromium have good impact resistance properties. Highest impact resistance was obtained on irons cast white and converted to gray irons by annealing.

Value of Drop Test

In the tests, transverse resilience correlated closely with impact resistance, and single blow impact tests made on machined bars apparently correlated more closely with transverse resilience than the repeated drop test on unmachined bars. H. A. Schwartz, National Malleable & Steel Casting Co., Cleveland, in discussing the paper pointed out that study of the data on repeated drop tests, giving proper consideration to various components entering into that test, showed the repeated drop impact tests would give a curve similar to that obtained with a single blow test. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., also spoke on the interpretation of single and repeated blow impact tests, and stated that while the single blow test paralleled the impact resilience value, the repeated blow impact test provided the most valuable information.

R. G. McElwee, Ecorse Foundry Co., Ecorse, Mich., spoke on the heat treatment of regular and alloy gray irons to obtain decreased or increased hardness, and of special irons which as cast have a white structure. Under the latter he described an iron containing 2.50 per cent carbon and 1.50 per cent silicon. Heat treatment of that iron at 1725 degrees Fahr. for 4 hours, cooling to 1325 degrees Fahr., and holding for 4 hours, followed by slow cooling to 1100 degrees Fahr., and air cooling, will show about 55,000 pounds per square inch tensile strength with 12 to 15 per cent elongation. With other treatment the strength can be increased to 90,000 pounds per square inch with a reduction of the elongation to 4 per cent. Brief discussion of the paper was participated in by A. L. Boegehold, General Motors Research Laboratories, Detroit, H. A. Schwartz and G. P. Phillips.

Foreign High Test Iron

The final paper of the session was that of George Delbart, Etablissement Cail, Denain, France, which, in absence of the author, was presented by J. S. Vanick, International Nickel Co., New York. The paper discussed industrial application of an alloy iron containing 3.75 per cent manganese and 6.5 per cent nickel which is austenitic as cast, but after heat treatment and air quenching becomes martensitic. That iron as cast has a tensile strength of about 29,000 pounds per square inch and a brinell hardness number of 150. Heat treatment at 1112 degrees Fahr., and air quenching increased the tensile to 46,000 pounds per square inch and the brinell to 420. The author stated that while steam engine valves and valve guides made from the alloy are in actual service, it is better fitted for heavy castings.

Wednesday morning's session on cast iron was held under the direction of J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., chairman, and W. H. Spencer, Sealed Power Corp., Muskegon, Mich., vice chairman. The first paper was that by A. Di Giulio, Ford Motor Co., and A. E. White, University of Michigan, Ann Arbor, Mich., which was presented by the former. It described

(*Continued on page 64*)

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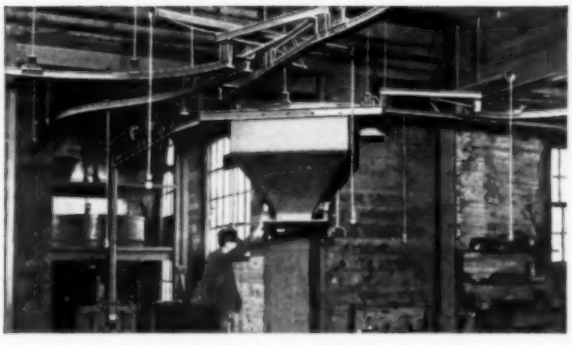

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(*Continued from page* 62)

the effect of superheating, pouring temperature and gas content on the structure and physical properties of gray cast iron. According to the authors beneficial effect of superheating was apparent at about 2700 degrees Fahr., and increased up to a maximum at 3040 degrees Fahr. The optimum pouring range was established between 2680 and 2850 degrees.

Written discussions on the paper were presented by R. A. Clark, Lakey Foundry & Machine Co., Muskegon, Mich.; R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, and A. C. Krynitsky, bureau of standards, Washington. C. H. Lorig, Battelle Memorial institute, Columbus, O., pointed out that the dendritic formation tendencies of some irons could be prevented by the addition of small quantities of alloying agents. Garnet P. Phillips said that in experiments on superheating, he found that steel-mix alloy irons were not improved by superheating while pig and scrap mixtures were improved.

Make Locomotive Cylinders

A. Reyburn, Canadian National Railways, Montreal, Que., presented a paper on progress in production of cast iron for locomotive parts. He said that at present all cylinders are made from iron containing 0.80 to 1.10 per cent silicon; 0.80 to 1.00 per cent manganese; total carbon, 3.00 to 3.20 per cent,and 0.75 per cent nickel minimum. Excellent results are obtained. Also nickel-chromium grate bars containing 1.50 to 1.60 per cent nickel and 0.60 per cent chromium are giving long service.

Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., presided as chairman of the cast iron session, Thursday morning. This session dealt specifically with the production of iron castings by the centrifugal process and featured four papers: "Production of Centrifugal Gray Iron Castings in Water Cooled Molds," by H. W. Stuart, U. S. Pipe & Foundry Co., Burlington, N. J.; "Slush Pump Piston Cores by the Centrifugal Process," by A. E. Falk, D & M Machine Co., Torrance, Calif.; "Cast Iron Pipe Centrifugally Cast in Sand," by J. T. MacKenzie; "Centrifugal Castings," by J. E. Hurst, Sheepbridge Stokes Centrifugal Castings Co., Chesterfield, England. In the absence of the authors the English paper was presented by the chairman while Mr. Falk's paper was presented in abstract by James T. MacKenzie.

The first paper covered a description of the process used to produce cast iron pipe centrifugally in steel molds and instanced some of the newer developments. The introduction dealt with the deLavaud process of manufacturing cast iron pipe, and explained in detail the various operations and equipment. The author then described the apparatus used to coat the steel mold with a pulverized material to prevent chilling of the outside of the pipe and instanced some of the problems encountered in the development of the process. The concluding part of the paper was devoted to a comparison of the properties of cast iron pipe produced with and without the mold coating.

The second paper dealt with the various factors and production problems involved in the centrifugal casting of special type castings. Design of the molding equipment and foundry layout is such that a continuous system is employed. Metal is melted in an electric furnace. Molds are alloy iron. Castings are heat treated. The face of the molds are washed with a diluted refractory cement, core oil and graphite.

Methods and equipment employed in the production of cast iron pipe in centrifugally operated sand lined metal molds were described by James T. MacKenzie.

J. E. Hurst's paper was confined principally to the methods and equipment employed in the production of cylinder liners. The molds are cast iron and in general normal atmospheric cooling is relied upon, and regularity of mold temperature for a given size of mold is ensured by strict control of the rate of casting. Metal is melted in the cupola to strict limits of accuracy in chemical composition and uniformity of physical and mechanical properties. Specifications for the castings vary to some extent, but the usual metal is a plain chromium alloy iron containing 0.4 per cent chromium. The castings are heat treated. The paper was illustrated by tables showing typical heat treatments and chemical analyses.

With the easy informality which characterizes meetings of that kind, members attending the round table meeting on cast iron Thursday afternoon, ranged over a wide territory in discussing the subject specified for the meeting, effects of nitrogen and oxygen. Nitrogen was totally ignored but to compensate for this omission, several members presented theories and personal experiences in connection with hydrogen. These experiences seem to indicate that hydrogen is a negligible factor. In one extreme instance a Russian experiment was quoted where hydrogen gas deliberately was introduced in the cupola. Beyond a slight increase in the temperature of the resulting iron, no other effects were noted. The composition, physical characteristics or mechanical properties of the iron did not differ in any manner from iron melted under ordinary conditions. Another member stated that he had passed a stream of acetylene gas through a bath of molten iron without affecting the resulting iron in any manner.

Properties of Coke

An extended discussion on coke disclosed that certain inherent properties in coal are transmitted to the coke, therefore an extended investigation of coal might prove of practical value to the foundry industry. Through a process of elimination, many forms of defects in castings may be traced to the coke, but there the trail ends for lack of intimate knowledge of certain hereditary properties in the original coal. The presence of small quantities of oxygen, *per se*, in iron is not necessarily detrimental. The manner in which the oxygen is present is the deciding factor. One member stated that the prevailing opinion regarding the pres-

(*Continued on page* 67)

E. W. Beach W. L. Seelbach R. F. Harrington V. J. Hydar H. V. Crawford

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H. M. St. John | John Ploehn | H. W. Stuart | C. W. Briggs | E. J. Mahin

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ence of occluded gases and their detrimental effect, is not based on a solid foundation of fact. The subject is in the debatable stage. This member also stated that molten metal is more susceptible to the absorption of oxygen while in the ladle, or while flowing through certain types of gates than it is in the cupola. Reverting to the subject of hydrogen a member referred to his experience in securing hotter iron with reduced volume of coke by soaking the coke in water before using. In this instance dry coke was used on the bed and in several succeeding charges. Thereafter the wet coke was used.

Effect of Cupola Slag

The theory was presented that the quality and quantity of slag in the cupola exerts an important influence on certain physical characteristics, particularly the grain size of the iron. First iron from a cupola before the bath is covered with slag, is weaker in structure and more open grained than the metal which follows and which passes through a slag bath.

The final session on cast iron was held Friday morning under the direction of Walter L. Seelbach, Forest City Foundries Co., Cleveland, chairman, and R. F. Harrington, Hunt-Spiller Mfg. Co., South Boston, Mass., vice chairman. The first paper was that by O. W. Ellis, J. R. Gordon, and G. S. Farnham, Ontario Research foundation, Toronto, on "Wear Resistance of White Cast Iron," and was presented by Mr. Gordon. It described some results obtained by testing cast white iron balls of different compositions in ball mills with ¼-inch silicon carbide abrasive grain as the abrading agent.

Following the presentation of that paper, W. H. Spencer gave the report of the international committee of tests. Mr. Spencer stated that specifications and methods of tests had been received from a number of European countries including Switzerland, Germany, Czecho-Slovakia, Spain, Italy, Holland, Belgium, etc., and that in general the highest tensile strength mentioned was 37,000 pounds per square inch; anything higher being classified as above that figure without specific data.

The final paper of the meeting, "Slags and Gases in Cupola Operation," by H. A. Dierker, Ohio State university, Columbus, O., was read by C. H. Lorig, Battelle Memorial institute, Columbus. The author pointed out that while the mechanical details of construction and operation of the cupola are simple, the physical chemistry involved is not, and that a thorough study of reactions taking place would prove profitable. David McLain, McLain's System Inc., Milwaukee; Fred J. Walls, International Nickel Co., New York; Henry Clarke, Sloss-Sheffield Steel & Iron Co., Chicago, and John Grennan, University of Michigan, Ann Arbor, Mich., discussed the paper. Mr. Walls said that in his opinion the volume as well as the composition of slag in the cupola is important, and that the gases and slag should be controlled similar to steel furnace practice.

Mr. Clarke said that volume of slag is important and that he found that a black slag gives the best results. The slag should be acid in composition. To insure a full slag volume, particularly in the early part of the heat, slag forming materials should be placed upon the bed. He stated that in conducting some tests an acid slag produced a close-grain iron from a cupola, but as the limestone content was increased the iron became open-grain. Mr. Grennan pointed out that investigations conducted have indicated that irons having a large austenite grain size have higher strengths, and that acid type slags promote large austenite grains.

Study Uses of Refractories

AN INTERESTING session on refractories was held Tuesday evening with C. E. Bales, Ironton Firebrick Co., Ironton, O., acting as chairman. In absence of the author, Mr. Bales presented the paper by C. L. Norton Jr. on "Some Uses of Insulating Fire Brick in Modern Foundry Practice." The brick described, in addition to possessing insulating properties, also has refractory qualities. It has been found useful in nonferrous melting units employing crucibles, and in steel casting annealing furnaces. It is claimed that fuel savings of over 25 per cent were obtained in brass melting units, and about 30 per cent in steel annealing when that type of brick was employed.

James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., in discussing the paper, pointed out that when insulation is considered, compromises must be made between refractories and insulation as it is possible to melt out refractories rapidly when too much insulating value was obtained. Some one inquired about use of insulation on cupola forehearths, and J. A. Bowers, American Cast Iron Pipe Co., stated that in his plant a 4½-inch refractory firebrick lining backed with semi-refractory, insulating brick gave satisfactory results. In lining the forehearth, the insulating, refractory brick is laid up carefully, and dried thoroughly. Then the refractory brick lining was laid up breaking the joints between the two linings, and then the whole dried.

E. G. Eggleston, Detroit Lubricator Co., Detroit, said that he found an insulating lining, comprised of a layer of diatomaceous earth followed by insulating brick and the regular refractory brick, gave good service. A. S. Nichols, Illinois Clay Products Co., Joliet, Ill., said that in insulated open-hearth furnaces the practice was to heat the face brick only to the same temperature as would be the case without insulation. That was

accomplished by controlling the heat input, and resulted in fuel saving. Don J. Reese, Whiting Corp., Harvey, Ill., mentioned that through insulating pouring ladles, it was possible in malleable foundries to increase capacity of bull ladles from 500 to 1500 pounds without having trouble with cold iron. He also stated that a large cylindrical type holding ladle, 54 inches inside diameter, and 11 feet long with a capacity of 11,000 pounds, which was insulated, showed a temperature drop of only around 50 degrees Fahr. from the spout temperature.

Following the discussion a paper by L. C. Hewitt, Laclede-Christy Clay Products Co., St. Louis, entitled "Malleable Furnace Refractories," was presented by M. A. Hosmer, Hunt-Spiller Mfg. Co., South Boston. It was pointed out that spalling resistance of bung brick has been improved, and side wall life has been increased through use of super fireclay brick and high temperature mortar. H. A. Schwartz, National Malleable & Steel Casting Co., Cleveland, in discussing the paper said that variations from shop to shop in life of different types of refractories possibly was due to melting procedures. In one excessive temperatures might be the prevailing factor, while in another, trouble from spalling may be encountered. Consequently, opinions on the value of the similar firebrick would not be the same.

M. A. Hosmer said he found that careful attention to laying up sidewall brick increased life considerably. He also said that good results were obtained by daubing up the slag line with a mixture comprised of finely crushed silicon carbide abrasive wheel stubs, firesand, and clay. J. M. Trantin Jr., Youngstown, O., stated that in a small regenerative open-hearth furnace, he found more satisfactory results were obtained with fire clay side walls and roof, than with silica or chrome brick.

Sand Course Holds Interest

INTEREST in practical shop operation was shown by the unusually large attendance at the Tuesday evening shop course on sand presided over by Neil I. MacArthur, Great Lakes Foundry Sand Co., Detroit. The subject of sand production, processing, grading and physical characteristics, particularly as applying to deposits in New York and New Jersey, was presented by Geo. F. Pettinos, Geo. F. Pettinos Inc., Philadelphia. Analysis of various types of sand were followed by a table showing the effect of grain size on the permeability. In this connection it is interesting to note that the permeability goes down as the moisture content goes up. Because of the multiplicity of grains in fine sand, the required amount of moisture is greater in fine than in coarse sand.

Answering a question from the floor Mr. Pettinos stated that the difference between silt and a true clay lay in the size of the particles. Supplementing this statement W. G. Reichert, Singer Mfg. Co., Elizabeth, N. J., stated that up to the present the A. F. A. has not differentiated between silt and clay, but that a committee now is working on that phase of the subject. He also stated that chemical analysis of the sand is of little practical value. A sintering test is more satisfactory in determining the adaptability of the sand for any given purpose. Mr. Pettinos agreed with this statement, but pointed out that customers have become accustomed to specifying the silica content in many instances and the sand producers must meet these requirements.

Natural and other types of sand used in the foundry depend upon the kind and grade of castings and type of finish. This fact was brought out by Horace Deane, John Deere Co., Moline, Ill., at the sand operation shop course held Wednesday evening.

Sand should be ordered for economy and in as few grades as possible, he stated. Permeability and strength of sand should be known. He recommended that the sand laboratory should have charge of the testing and ordering and should cooperate with the molding foreman. Sand with round grains appears to give greater permeability than sand with angular grains, he pointed out. Grain size and distribution are becoming more important from the standpoint of finish. If natural sand is added in small lots, he stated in conclusion, the finish is better and less sea coal will be required.

Prefer Riddled Sand

A speaker mentioned that a foundry producing automobile cylinder blocks and also boiler sections from 8 to 900 pounds used the same grade of sand in a continuous mold and pouring system. In discussing the treatment of sand one member brought out an interesting suggestion bearing on the subject. Riddled sand will be more open than sand not subjected to this treatment, he stated. You cannot erase the riddling effect, he contended, no matter how much the sand is rammed. Riddled sand produces castings with a smoother finish.

While tests for permeability and bond strength of sand are important one speaker stressed the fact that the sintering point has a more important bearing on casting practice than generally is conceded. Another speaker brought out the fact that castings cannot be enameled satisfactorily when the sand washes or burns on and the sintering point of the sand has an important bearing in this connection.

In discussing the best mold facings to use for heavy grades of castings poured at 2550 degrees Fahr., one member recommended the use of a graphite to close up the facing and to assist in getting the gases away in back of the surface of the mold and flask. It is easier, he explained, to obtain sound sand castings when the flasks are vented properly.

(*Continued on page* 70)

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(*Continued from page* 68)

By increasing the permeability of the sand from 90 to 200 a maker of large sheave wheels was able to eliminate practically all pin holes.

The content of clay in sand is far more important than the grain size in the opinion of one foundryman. It is far better to consider the fineness and clay content on incoming shipments of sand, he contended, than the permeability and strength.

Another speaker mentioned that there is a growing tendency in the foundry industry toward a more uniform grain structure of sand, the use of a harder ram and a mold that is open enough to take care of the gas conditions. By adopting this practice, he asserted, it is possible to improve the finish on castings, to hold them to a close tolerance and to reduce the cleaning costs at least 50 per cent.

Another trend noticeable in foundry practice today is the increased use of sea coal, an increase in the use of dry graphite and the use of a finer and more uniform sand, according to another speaker.

Discuss Synthetic Sand

Synthetic sands, their development, application, limitations, and probable future place in the foundry industry engaged the attention of foundrymen at the early session, Thursday, under the chairmanship of R. F. Harrington, Hunt-Spiller Mfg. Co., Boston. One of the pioneers in this phase of foundry activity, Mr. Harrington was particularly well qualified in presenting an outline of the subject which first was taken up officially by the A. F. A. in 1921. The first tentative standards in connection with classification of molding sands were adopted by the association in 1924. Individual experimentation with clay and other materials as bonding agents had been tried spasmodically for many years antedating that period, but concerted, organized investigation of the properties and the various characteristics and applications of molding sands constitute a comparatively recent phase of activity.

In illustration of this claim that the adoption of synthetic sand effects a considerable reduction in operating cost, the speaker quoted figures covering the cost of natural molding and core sand at his plant in Boston. Bank sand $1.35, freight $3.30, emergency freight 23 cents, a total of $4.88. To this is added further incidental handling costs in the shop and final disposal amounting to $1.30 a ton. From another deposit the cost of the sand is $1.75 at the pit, freight $2.25 plus emergency freight of 15 cents, a total of $4.15 per ton. Core sand costs $1.00 per ton, freight $2.25 and emergency freight of 8.4 cents, a total of $2.28.

In the preparation of synthetic sand the speaker emphasized the necessity of thorough mixing. Where formerly an addition of 25 per cent new sand was required in the heap, equally satisfactory results now are secured by the addition of a small amount of clay at a reduction in cost. In a dry sand molding sand mixture the cost has been reduced in the same manner.

New sand in reduced amounts still is added principally to maintain volume. This sand is bought to close specifications and the speaker paid tribute to the sand producers who worked closely in co-operation. He also directed attention to the fact that there is a wide difference between various types of clay and a different technique is required in their manipulation. Answering a question from the floor in regard to the disposal of fines, he stated that this is not a factor in their present practice. A higher than usual permeability is maintained in all mixtures.

Feature Operation of Cupolas

AN ANIMATED discussion in which several speakers presented widely divergent views followed the presentation of a paper "Relation of the Air Charge to Cupola Operation," by H. V. Crawford, General Electric Co., Schenectady, N. Y., at the cast iron shop course session, presided over by Fred J. Walls, International Nickel Co., New York.

Illustrated by several slides the paper discussed the various reactions that take place within the cupola and showed how best to operate the cupola. The author divided the cupola into zones and explained the functions and reactions in each, also how improper control of air supply coke and iron charges influence the thermal efficiency and consequently the efficiency of the cupola as a melting unit.

James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., claimed that some of the statements did not coincide with his experience. He claimed that the amount of air should vary with the height of the bed, and was not a factor of importance in relation to the thickness of coke between the charges. In support of his contention he claimed that by adjusting the bed and varying the volume of air he can regulate the speed of a cupola from 40 to 10 tons per hour, without any variation in the temperature of the metal.

Lively discussion followed a question from the floor as to whether a higher bed is required to melt charges containing large amounts of steel. According to the views of several members the steel absorbs a certain amount of the carbon from the fuel, therefore a sufficiently large amount of coke should be charged to compensate for this loss.

John Grennan, University of Michigan, Ann Arbor, Mich., presented a paper prepared jointly by himself and Prof. H. L. Campbell, showing the result of a series of experiments to determine the relative amounts of CO and CO_2 generated in a cupola under various operating conditions.

The second shop course on cast iron drew a good attendance on Wednesday evening. John Grennan, chairman of the meeting, called upon H. C. Aufderhaar, Electro Metallurgical Co., Chicago, to present a paper written in collaboration with E. K. Smith of that firm, entitled, "Adding Ferroalloys in the Cupola". The authors gave much interesting information on typical cast iron heats in which the various alloys were added in the form of briquets to produce either high strength or alloy cast irons. The alloys added in briquet form ranged from 1.20 per cent silicon and 0.15 per cent manganese to 25.50 per cent chromium to produce final irons of compositions for specific applications.

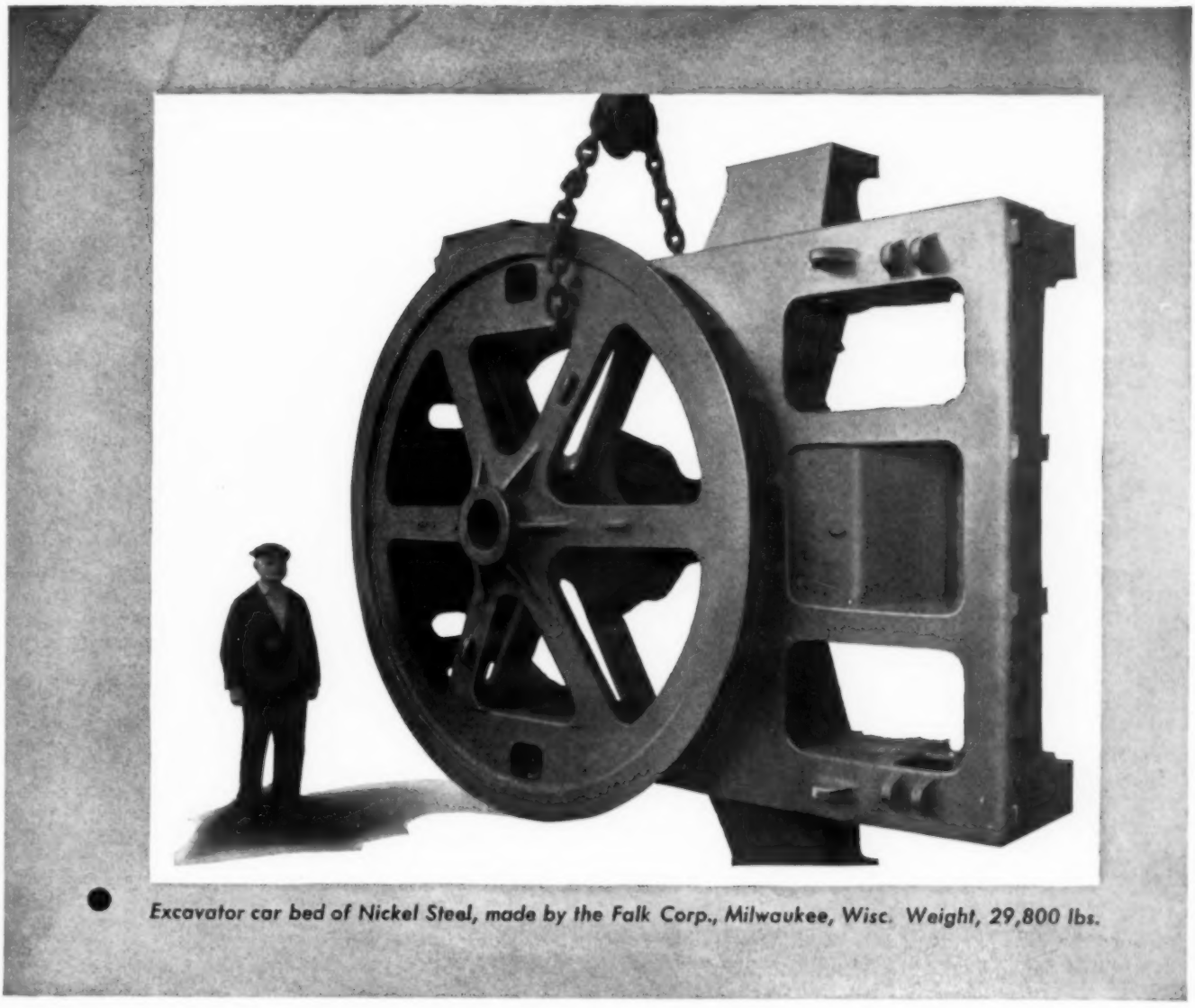
Place Briquets in Center

In the discussion it was pointed out that the briquet form ferroalloys preferably should be placed on top of the coke and in the center of the cupola. In cases where only a part of the day's heat was devoted to special alloy mixtures it was advisable to drain off all the regular iron, rebuild the bed to the proper point, and then charge the special mixture. In that way there is little chance of contamination, and in addition insures that the alloys will be where desired. A question was asked on the load bearing properties of the briquets, and it was stated that they would withstand extremely hard usage without fracture.

Use of briquets is an excellent method of permitting greater use of scrap in the mixtures. Those containing ferromanganese and ferrosilicon seemed to have a deoxidizing effect as the chill, as indicated by chill bar tests, is not as great as without their use. Recovery with briquets was said to be about 95 per cent in the case of ferrochromium. Ferrosilicon briquets showed a loss of about 10 per cent, and manganese about 13 per cent.

One speaker pointed out that when

(*Continued on page* 72)



Excavator car bed of Nickel Steel, made by the Falk Corp., Milwaukee, Wisc. Weight, 29,800 lbs.

NICKEL IMPROVES THE MECHANICAL PROPERTIES OF STEEL CASTINGS AT MODERATE COST

THE pearlitic nickel-manganese steels occupy an important position among modern engineering materials. They are widely used for miscellaneous constructional castings where uniform and dependable performance at moderate cost, is desired. No special technique is required in the production and handling of these castings, which are reported to be less susceptible to hot cracking than carbon steels.

RANGE OF COMPOSITION:

Carbon 0.25–0.40% Manganese 1.00–1.50%
Nickel 0.75–1.50%

In the normalized and drawn condition these steels are best adapted for castings of light and medium section, such as stressed members of tractors, motor trucks, road building machinery, railway cars, etc.

You are invited to discuss with our development staff your service requirements or manufacturing problems. Literature available upon request.

TYPICAL PROPERTIES DEVELOPED AFTER NORMALIZING AND DRAWING TREATMENTS

Composition					
Carbon	0.25–0.30	Carbon	0.27–0.35	Carbon	0.35–0.40
Nickel	0.75–1.00	Nickel	1.25–1.50	Nickel	1.25–1.50
Manganese	1.00–1.25	Manganese	1.25–1.50	Manganese	1.25–1.50
Tensile Strength, psi.	80,000		90,000		100,000
Yield Point, psi.	50,000		60,000		70,000
Elongation in 2" (%)	30		25		20
Reduction of Area (%)	55		50		40
Izod Impact (ft. lbs.)	50		40		30
Brinell Hardness	175		200		230
Endurance Limit, psi.			49,000		

NICKEL

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NRA CODE

(*Continued from page 70*)
all scrap or high scrap mixtures replaced pig and scrap mixtures, all the improvement should not be attributed to the addition of ferroalloys as part of the effect was due to changes in melting speed, etc. It also was stressed that when changing from pig and scrap to all scrap and ferroalloys, that it was not advisable to make radical changes in other variables until some results are obtained. Then definite changes should be made gradually to obtain the best results.

Steel in the Charge

Converter and cupola duplexing was discussed by Don Reese, Whiting Corp., Harvey, Ill., at the Thursday morning shop course on cast iron presided over by J. A. Sweeney, Florence Pipe Foundry & Machine Co., Florence, N. J. The speaker referred to the growing importance of cast iron compositions differing widely from compositions formerly accepted as orthodox. A noticeable tendency is toward the production of irons low in total carbon and possessing higher tensile strength and other physical properties superior to those formerly obtainable.

A large addition of steel scrap in the charge is the principal factor in securing these results. While the manipulation of the heat is quite feasible in the electric furnace, certain limiting factors prevent the same ease of manipulation in the cupola where the entire charge is melted and where the low total carbon content of the metal is changed by the absorption of carbon from the fuel. This difficulty is overcome, the speaker stated, by the duplexing process where a certain amount of the charge is treated in a converter and then added to the remainder of the metal melted in the ordinary manner.

One of the advantages of the process is the ease of operation and the extreme flexibility of the method. The final metal in the ladle may be varied from an addition of 10 per cent steel to a possible maximum of 90 per cent. In a fairly common mixture containing 45 per cent steel and 55 per cent iron, the carbon content will vary from 1.40 to 1.60 per cent, silicon 1.30 per cent, manganese from 0.60 to 0.70 per cent, with correspondingly low percentages of sulphur and phosphorus. A single cupola serves to melt the iron which is tapped directly into the ladle, and the iron which is treated in the converter. In calculating the charge the usual allowances are made for melting and conversion loss.

Training Seen as Pressing Need

SHORTAGE of skilled labor in practically all occupations is becoming more apparent despite the fact that many foundry employers pushed their apprenticeship programs to the limit for many years prior to the depression. In fact, a few have continued their training programs, and even increased them throughout the past 5 years in the face of uncertainty and loss of revenues.

These facts were presented at the apprenticeship training session, Thursday morning, by Victor Hydar, director of personnel, Falk Corp., Milwaukee, who reviewed foundry apprenticeship for the past 15 years at his company's plant. No complicated interviewing system or any so-called aptitude tests or examinations are employed, he stated. An interview is calculated to build up a correct first impression of the applicant. His general appearance, manner, bearing and personality are given their proper consideration and much emphasis is placed upon consistency between his high school curriculum and the trade he is seeking. But what is more important, provided the applicant is acceptable, Mr. Hydar stated, is that he first is given a trial on the company's proving ground—the Milwaukee Vocational school—before he is brought into the plant.

Discussion of Mr. Hydar's paper brought out the fact that the schooling of the applicant on trial ranges from one to three months. Technical training given an applicant, Mr. Hydar pointed out in answering a question from the floor, includes a shop program laid out in a definite schedule such as work in green and dry sand bench and sweep molding, coremaking, a short period in the cleaning room, and some optional training in melting and annealing.

Pattern Work Optional

Apprentice molders do not have to have any pattern work although it is included in the optional part of their contract, stated Mr. Hydar in reply to a question submitted by Harry H. Comstock, Syracuse Chilled Plow Co., Syracuse, N. Y. Apprentices at the Falk plant are divided in employment periods and are assigned a definite pay rate, the starting rate being 28 cents an hour and the finishing rate 55 cents an hour.

B. G. Parker, Youngstown Foundry & Machine Co., Youngstown, O., related the difficulty involved in keeping the boys when the starting rate is set at a low figure. He stated the present plan followed by his company is to start the apprentice at the rate paid in the district which at present is 40 cents an hour. This arrangement keeps the boy satisfied.

Walter L. Seelbach, Forest City Foundries Co., Cleveland, cited the co-operative state-city employment plan in effect in Cleveland and suggested that the best arrangement is to pay a rate in accordance with the conditions of the times. A good rule to follow, stated John H. Ploehn, French & Hecht Inc., Davenport, Iowa, and chairman of the session, is never to hire an apprentice over 18 years of age for those above that age invariably leave before serving their apprenticeship.

Lack of training personnel to fit them for various positions in the foundry industry was stressed by J. E. Goss, employment manager, Brown & Sharpe Mfg. Co., Providence, R. I. For many years the superstructure of many industries, including the foundry industry, has been built on a trembling foundation, he declared in presenting his paper on "Some Suggestions for Starting and Carrying Out a Foundry Apprenticeship System."

Training Program Needed

An apprentice, who after finishing his course is given regular employment by the company, likely will be loyal to his employer. The need for molders is acute, he said. At least 5 per cent of skilled foundry employes normally is lost each year and in addition the industry is handicapped by men who since the depression have gone into other lines of endeavor and never will return to the foundry ranks because they have found steady employment elsewhere. During the years foundry molders have been passing out of the picture the industry has done little in the way of training men to take their place, he pointed out, and then asked the question—"How else are we going to get molders unless we train them ourselves?"

Mr. Goss emphasized the importance of starting with good material. The proper contact must be made with the right sources of supply. This can be done, he explained, by making personal visits to schools and by circular letters and booklets. Various means for separating the chaff from the wheat were cited such as school records, mental ability tests and mechanical aptitude. He stressed the importance of interviewing an applicant. Raw material entering into foundry products is checked; then why not examine the person who is to handle these materials for this is equally important.

The minimum age limit for apprentices should not be under 17 years nor the maximum over 20 years in the opinion of the speaker. Unless the time factor is stressed along with the need for quality, he warned, we have not produced a good molder. An apprentice should be rated at 75

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ADVERTISING PAGES REMOVED

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per cent in comparison to a journeyman molder.

A program was cited by the speaker as a highly essential part of apprenticeship. Not only should the apprenticeship work be centralized but a record should be made of those on trial by employing a regular form. The trial period at Mr. Goss' plant in Providence, R. I., is three months.

A cash deposit is required of the boy at the time he makes the agreement. While this procedure frequently is questioned, the speaker said, his company has found it obviates the apprentice jumping his contract. The deposit later is refunded after the boy has finished serving his apprenticeship.

Discuss Standards for Sand

EXPANSION and contraction of the sand in the mold when heated to a high temperature and then cooled are responsible for cuts, scabs, rat tails and other forms of casting defect, according to a paper prepared by H. W. Dietert and F. Valtier and presented by Mr. Dietert at a sand research session presided over by H. B. Hanley, American Laundry Machinery Co., Rocheter, N. Y.

The oral presentation was supplemented by a number of slides showing laboratory equipment for sand testing in this particular field of activity, charts showing the behavior of various grades of sand under different ramming and temperature conditions and reproductions of photographs of surface defects on castings directly traceable to the phenomenon of expansion and contraction of the sand. Naturally, hard rammed sand resists contraction and expansion more than soft sand. Bond, permeability, moisture content, grain size and density of ramming constitute important factors in any investigation dealing with this subject.

Dr. H. Ries, Cornell university, Ithaca, N. Y., presented a report covering the past, present and future activities of the sand testing committee. The work first was undertaken by the American Foundrymen's association about 15 years ago and while a considerable amount of progress has been made the field constantly has expanded in directions beyond all original anticipation. As a result the committee has become increasingly cautious in arriving at conclusions or in recommending tentative standards. For example in the early stages a uniform size, round grain sand was assumed to have the highest permeability, and was adopted as a standard. Later investigation proved this assumption incorrect. Likewise, in comparing tests for clay content, it was found that the temperature of the water exerted an important bearing on the final results.

Outlines New Method

Other features touched upon included standards for grain size, flowability of sand under compression, characteristics and application of bonding clays, sand specifications. The committee finds it difficult to determine exact specifications. In conclusion he referred to the wide discrepancy obtaining in the methods of sand testing among foundrymen in various countries in Europe. A revised edition of A.F.A., sand testing methods soon will be issued to supersede the pamphlet published in 1931.

W. G. Reichert, Singer Mfg. Co., Elizabeth, N. J. explained a proposed method of determining sand characteristics by grain size which insures greater accuracy.

H. W. Dietert outlined present methods of conducting durability tests and reported progress in the development of a new and shorter method.

Probe Steel Casting Practice

CONDITIONS which determine solidification of metal in steel casting practice may be classified as external and internal. The external conditions are those which initiate and control the cooling of the steel and are determined by the physical properties of the steel.

These points were brought out at the session on steel castings Thursday morning, by Charles W. Briggs, division of physical metallurgy, U. S. Naval research laboratory, who as a co-author with Roy A. Gezelius of the same laboratory, presented a paper on "Studies on Solidification and Contraction in Steel Castings." This paper, which dealt with the rate of skin formation, was the third of a series presented by the authors before the association.

Freezing of the steel occurs in three successive steps and includes either instantaneous, rapid or comparative slow freezing. The chief factors influencing the solidification of steel castings, as cited by the speaker, are type, shape and size of molds; temperature of the steel above its melting point; physical properties of the steel; and, temperature of the mold.

Characteristics of the mold determine the length of time it requires before solidification is complete, Mr. Briggs stated. As the rate of cooling decreases the time required for the steel to pass through the freezing range increases and the velocity of solidification is altered. Initial rate of skin formation is decreased by pouring the casting with superheated steel. Rate of solidification of a metal in a mold depends to a certain extent upon the temperature of the mold prior to the pouring operation.

In conclusion the speaker pointed out that the rate of skin formation increases as the volume of the steel casting decreases and the greater the surface area of the steel casting the faster is the rate of skin formation. He mentioned that the factor of solidification is a constant; that is, at any definite time after pouring the volume of steel solidified per square inch of mold surface is the same. Variations in the ordinarily used molding materials results in little more than a perceptible change in the velocity of solidification. Moreover, the degree of superheat modifies the rate at which the skin forms. And finally, the speaker stated, calculations of the rate of skin formation can be made and predicted in various sizes of sphere castings.

Recommendations of the A. F. A. committee on chemical classification of foundry steels, which have been under study for the past 2 years, were presented in printed and final form.

To Form Committee

A paper entitled "The Influence of Temperature Gradients in the Production of Steel Castings" by George Batty, Drexel Hill, Pa. was abstracted by John Howe Hall in the absence of the author. This paper was published in the July and August, 1935 issue of THE FOUNDRY.

Concensus of opinion of those who attended the round table luncheon conference dealing with steel castings was that in view of there being no standard method for testing steel castings a body should be organized to clarify the condition. The importance of standardizing methods for testing castings of that grade by setting up physical test coupons was stressed by several members. Many members, therefore, were of the opinion that a committee should be formed for this purpose.

While there are many questions involved in radiographic examination, those engaging in the discussion voiced the opinion that a committee also should be formed to study radiography of steel castings and advise members.

Discussion was opened by the chairman of the session A. W. Gregg, Farrell-Cheek Steel Foundry Co., Sandusky, O. Problems associated with the cooling of molding sand were discussed at length. One executive pointed out that as long as the tem-

perature of the sand at his plant was kept below 100 degrees Fahr. no trouble was encountered but as soon as the temperature increased to around 115 to 120 degrees then difficulty was experienced. The method used at this plant involved the shaking out in two separate piles and allowing one to cool while drawing the supply from the other.

One speaker mentioned a plan followed at a plant in Switzerland for cooling the sand. The material is returned from the shakeout floor on a steel belt, 24 inches wide, upon which air impinges. At one American plant the hot sand is conveyed to three storage tanks and the practice is to alternate the three separate batches.

Punchings from copper strip added to molding sand affords a quick conduction of heat away from the casting but the copper is difficult to reclaim after the shakeout according to a foundryman. To use magnetic separation his shop is now trying stainless steel punchings. Another member told of using machine shop chips in the proportion of half chips and half core sand for making cores. However, he stated, the steel with its sharp edges becomes imbedded in the core box and difficulty is experienced in removing the core.

Application of welding and radiography to steel foundry problems was discussed at a session on steel foundry practice held Friday morning. John Howe Hall, Taylor Wharton Iron & Steel Co., High Bridge, N. J., presided.

Welded Steel Castings

J. M. Sampson, General Electric Co., Schenectady, N. Y., presented an outstanding paper on the fabrication of cast steel to rolled steel stock. He showed the results of extensive tensile, bending, shear and fatigue tests on specimens of cast steel welded to ordinary rolled steel plate. When the data incorporated in this paper becomes generally available in printed form, it will constitute valuable information for the guidance of foundrymen and welders who see the opportunity for greater co-operation between the arts of casting and welding.

Mr. Sampson showed illustrations of jobs which originally had been cast complete; then had been fabricated from castings, plates and bars by welding; and finally—as a result of thorough investigation—had been redesigned to use cast and rolled steel in the proportion which brings out the advantages of both materials most effectively.

In the ensuing discussion, to which P. E. McKinney, Bethlehem Steel Co., Bethlehem, Pa., was an important contributor, the thought was expressed that the combination of welded steel and cast steel parts by welding offers unlimited opportunities to steel foundrymen.

Mr. McKinney declared that the time has passed when the foundryman can say that welding is not a serious competitor of castings. Welding castings to rolled steel, in his opinion, is a "real step forward." To which observations, Mr. Sampson responded that "rather than see work go away to welders, foundrymen should secure good welding facilities and go into the business of providing customers with the proper combination of cast steel and rolled steel, fabricated by welding, which afford greatest service and economy."

Utilize x-Ray

A paper on x-ray and welding as aids to the production of quality steel castings, by C. M. Underwood and E. J. Ash, Naval Gun factory, Washington, was presented by Mr. Ash. He described a portable x-ray machine employed by the navy in the investigation of castings and explained how defects thus discovered, after careful cleaning and other preparation, are repaired by welding.

In the discussion which followed, the old question of carbon content arose. For welding, carbon in the twenties is preferred, but from the standpoint of the foundrymen, carbon of 0.30 per cent or more is desirable. The consensus of opinion seeemd to be that under modern advances in both casting and welding, an agreeable compromise on carbon should not be difficult.

Charles W. Briggs, U. S. Naval research laboratory, raised the question as to whether positive prints of radiographs should be used in illustrating casting defects. He recommended the use of the negative print, since that is similar to the films used on the foundry floor. Mr. Ash, in replying to this comment, referred to the fact that in reproducing radiographs for publication, the double reproduction involved in presenting the negative entails a considerable loss in detail in the print.

All who discussed the use of X-rays consider it an invaluable aid in the production of castings, particularly when coupled with intelligent salvaging accomplished by good welding technique where defects may be revealed.

Stress Value of Equipment

MANY advantages to be derived from mechanical handling of materials, particularly in small and medium size foundries were outlined by E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., at the Wednesday session on materials handling and foundry equipment. Contrary to a somewhat prevalent belief, mechanical methods of handling sand and other materials readily may be adapted to the requirements of the ordinary foundry making a special or a miscellaneous line of small castings.

As a typical example he presented an illustrated description of the equipment and method of operation in a small foundry with a daily capacity of 7 tons of light gray iron castings. The equipment in that foundry cost approximately $12,000. Adoption of the equipment resulted in savings sufficient to pay off the cost in 3½ years. Among the savings listed is a reduction from 5 cars to 1½ cars of new sand per year. The equipment includes a monorail system, a number of sand buckets and a sand preparation plant. The monorail system is utilized to transport sand, castings and also hot metal from the cupola.

After the castings are poured they are dumped on a vibrating screen. The castings are removed and placed in metal buckets suspended from the monorail and taken to the cleaning room. Sand falls on a belt from which it is carried aloft and dumped in a storage bin. A measured quantity of sand from this bin falls into a muller where it is mulled for approximately 2 minutes. Any required amount of new sand, water or other material is added to recondition the sand for any given variety of castings. Sand from the muller is discharged into a bucket with a capacity of 1000 pounds. This is hoisted from the pit and then conveyed by monorail to any of the molding stations. The empty bucket is returned to the filling station. By a constant rotation of buckets the molders are supplied steadily. The molder opens a gate and the sand falls into his flask.

Charging the Cupola

At the same session presided over by James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind., Don J. Reese, Whiting Corp. Harvey, Ill., presented a paper "Mechanical Charging for Small Tonnage Foundries" in which he pointed to the entire feasibility of adopting mechanical charging methods and equipment to foundries melting as low as 3 to 5 tons per hour. The equipment may vary from a simple skip hoist to a more elaborate monorail system and the cost may vary from $500 to $10,000. Citing a typical example of a recent installation in a foundry melting 35 tons per day,

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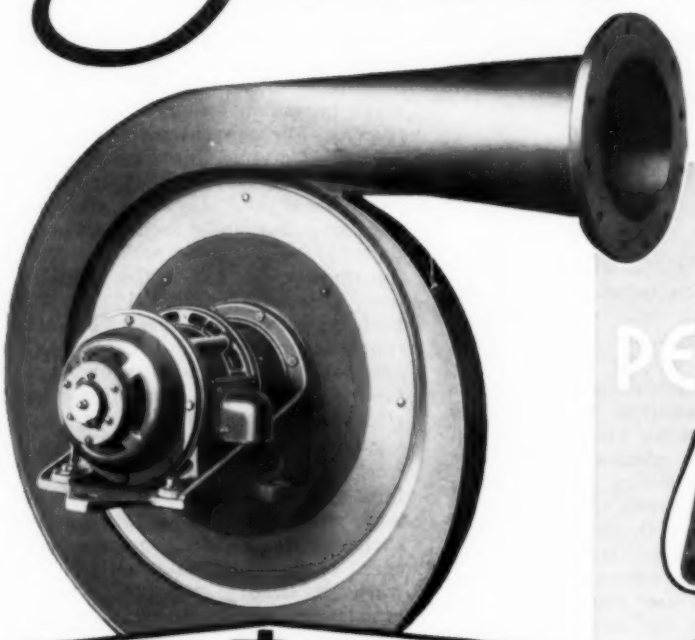
Streamlined INSIDE



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PRACTICAL streamlining within the Motorblower insures lower power bills. From more than twenty years of research, our designing engineers have learned much about the behavior of air and other gases within the blower. Gradually these findings have been incorporated in the present-day, highly efficient design.

Streamlining, resulting from this research, has eliminated wasteful turbulence at every possible point and has placed the Motorblower in the class of modern, economical machines.

Three examples of this streamlining are shown at the left. At the top is one of the fish-tail spacers (this name was applied before "streamline" became a recognized term) which brace the casing walls. In the center is shown the carefully designed inlet nozzle which streamlines the air before it enters the eye of the impeller. A typical impeller is shown at the bottom. Motorblower impellers are streamlined throughout, and the blades at the eye of the impeller are curved to receive the air with minimum shock and entrance losses.

MOTORBLOWERS are compact, two-bearing machines with motor rotor and blower impeller mounted on a single, rigid shaft. Grease- and dust-tight ball bearings require little attention, and eliminate common bearing troubles. Single-stage units range in capacity from 350 to 15,000 cu. ft. free air per min., while pressures range from 0.75 to 3.0 lbs. per sq. in. Send for catalog 2161 for full details on single-stage Motorblowers.

Birmingham, Boston, Buffalo, Butte, Chicago, Cleveland, Dallas, Denver, Detroit, Duluth, El Paso, Honolulu, Knoxville, Los Angeles, Newark, New York, Philadelphia, Picher, Pittsburgh, Salt Lake City, San Francisco, Scranton, Seattle, St. Louis, St. Paul, Tulsa, Washington

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he claimed that the savings effected in a 12 month period paid for the cost of $9000.

In this instance several factors raised the cost. The cupola had to be moved back on a new foundation, the charging door was raised 7 feet and a runway built for the monorail. Under the old arrangement 5 men were required on the charging floor and two or three additional men were required in hot weather on account of the low head room. Under the new arrangement two men attend to all the charging. Further, after standards were established these men required no supervision. Replying to a question from the floor the speaker said that a high charging door effected a considerable saving in the amount of coke required. Speaking generally, the economies effected by mechanical charging are more noticeable in cupolas where the heats extend over a period of 4 hours or more. However, economies are effected on smaller heats.

Reviews Dust Control Methods

SINCE the subject recently has developed into a live and important issue, the American Foundrymen's association included in the current program a session dealing with dust control and safety codes in the foundry. This session on Friday was conducted under the chairmanship of E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

In discussing the subject, J. D. Leitch, Provincial department of health, Toronto, emphasized the necessity of controlling dust at the source, rather in developing methods of collecting it later. Following a brief general survey of the dust problem he presented instances of specific cases in the foundry industry where basic principles were ignored and the results were unsatisfactory.

Many Methods Available

Many methods are available, but in nearly every instance an intelligent study is required to determine which method, or which style of equipment is best adapted to meet the individual problem. Lack of uniformity in the various state laws dealing with the subject of dust prevention and collection constitutes a formidable obstacle in the path of individuals or organizations trying to solve the problem. Certain recommendations and standards adopted by the American Society of Heating and Ventilating Engineers should be in the hands of all who are studying the subject of dust prevention or dust elimination. In conclusion Mr. Leitch described the various types of equipment at present available and from his standpoint pointed out the strong and the weak features of each type.

In a paper "Dust Collection in the Foundry" presented by S. D. Moxley, American Cast Iron Pipe Co., Birmingham, Ala., the author discussed the problem under three heads namely apprehension, collection and disposal. The paper was illustrated by several slides showing typical devices for trapping dust including suction type, centrifugal, cloth filters, electrical precipitation, wet dust style and froth flotation style. In addition, a table showed the size and characteristics of air borne solids while a second table showed the volume of air required, micron size, temperature limits, moisture limits, maximum dust concentration inlet and outlet, efficiency and relative cost of various types of dust collectors. In the author's opinion the most satisfactory method of expressing effectiveness would be the concentration and dust count of the air exhausted from the collector. This information may be obtained by various forms of apparatus including the impinger dust sampling apparatus by the United States Public Health Service. These values can be compared with those thought to represent safe atmospheric working conditions.

A description of cloth arresters by J. R. Allen, International Harvester Co., Chicago, was followed by reports of A. F. A. representatives on A. S. A. safety code committees.

French Association Plans Annual Congress

The annual congress of the Association Technique de Fonderie, of France, will be held in Paris from Oct. 20 to 26 in conjunction with the seventh international congress of mines, metallurgy and applied geology, organized by Societe de l'Industrie Minerale, Comite Central des Houilleres de France, Comite de Forges de France, Societe Geologique de France, and Revue de Metallurgie, and under the patronage of the President of the Republic. The chairman of the congress committee is Henry Le Chatelier, of l'Institut de France, and the organization committee is headed by Leon Guillet, also a member of l'Institut de France. The metallurgical section, of which the foundry congress will be a sub-section, is presided over by Prof. Portevin, past-president of Societe des Ingenieurs Civils de France.

Book Review

Gates and Risers for Castings, by Pat Dwyer, engineering editor THE FOUNDRY; cloth; 364 pages; 6 x 9 inches; published by the Penton Publishing Co., Cleveland and supplied by THE FOUNDRY, Cleveland, for $3.00 plus 15 cents postage, and in Europe by the Penton Publishing Co., Ltd., London, England.

This book covers in a detailed, comprehensive and authoritative manner practically every phase of one of the most important branches of molding practice. For convenient reference the subject is divided into five main sections, dealing respectively with gray iron, brass and bronze, aluminum, steel and malleable iron. As a further aid to a reader seeking specific information on any given point, the book is provided with a 14-page index listing nearly 2000 items. The text is supplemented by 243 illustrations of original line drawings showing the function and application of gates and risers in almost infinite variety.

A brief outline of the scope of the work is shown in the following headings for the 27 chapters: Dirty castings, nomenclature, pouring methods, shrinkage, skimmers, pouring basins, cored castings, pencil gates, top gates, warpage, bronze castings, aluminum bronze, temperature, shrinkage, statuary, dross in copper, aluminum temperature, pouring height, aluminum alloys, steel castings, chills, heads, piping, heat gradient, ladles, hidden defects, centrifugal process, steel chains, malleable iron, design, cupola metal, pattern arrangement.

Extent to which the subject of each chapter is elaborated is illustrated for example in Chapter 1 which covers analysis of lost castings, origin of dirt, top and bottom pouring, advisability of risers, every casting rule to itself, pressure needed, slow pouring, cause of dirty castings, strainer cores, gates in cores, cylinder gates, clean basins. The book serves a two-fold purpose (1) A guide in the proper selection of size and type of gate for any purpose (2) An answer to the perennial question "Why is a certain casting defective?"

This book written by a practical molder of exceptionally wide experience covers the subject intimately from the inside or shop view point and is highly recommended to foundrymen either of limited or wide experience. It will prove a mine of knowledge to apprentices, molders, foremen, patternmakers, metallurgists and others connected with the foundry industry whose former knowledge of the subject has been limited through lack of either time or opportunity. Owners of foundries will find it advantageous to place copies in the hands of ambitious workmen, or those engaged in directional or supervisory capacities. The book will serve as an admirable textbook either for self study, or in organized classes where foundry practice is taught.

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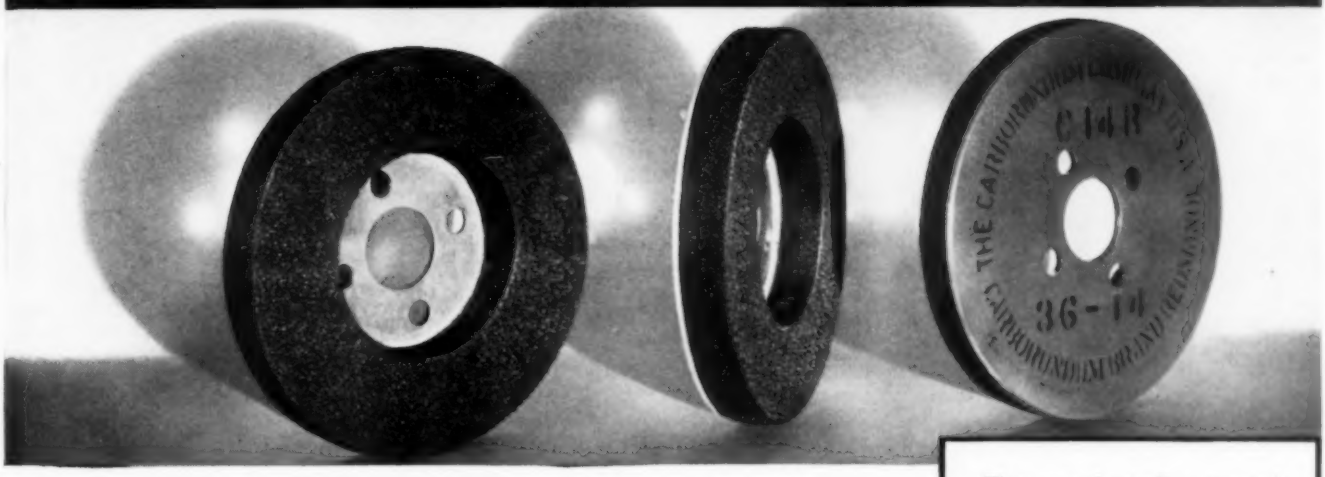

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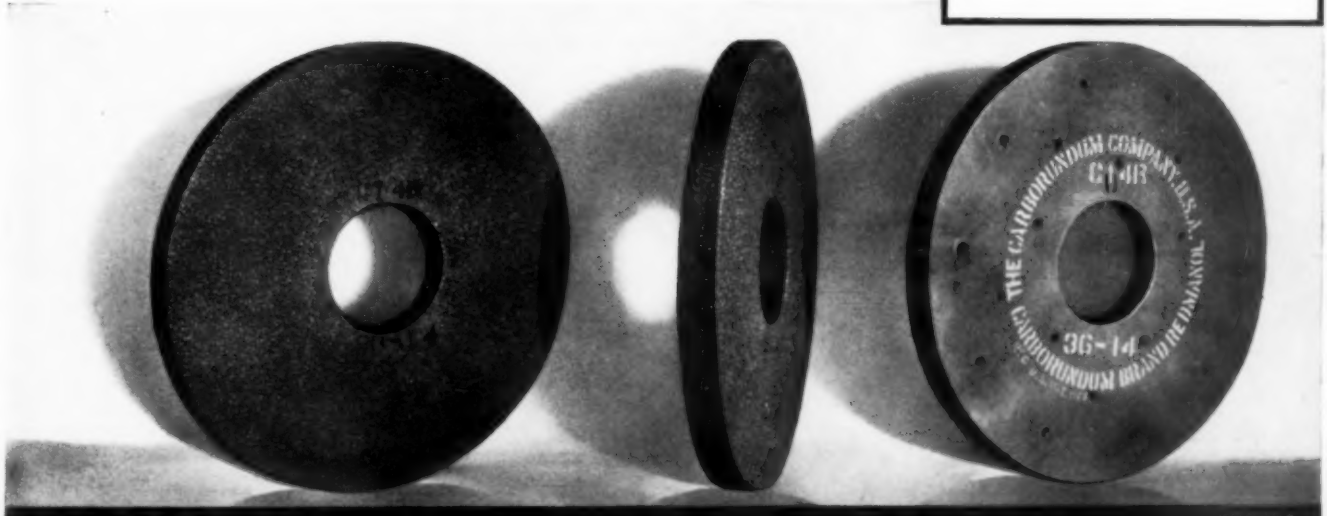

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Producing a Large Lead Casting

(*Continued from page* 29)

iron or various nonferrous metals.

On similar gray iron castings we would allow ⅛-inch on the bottom flange for finish, and ⅜-inch on the top flange. On the first lead casting for the evaporator we allowed ¼-inch on the bottom flange and 1-inch on the top flange. The result was not as anticipated and we had to abandon that idea on the bottom head, the second casting made.

A gray iron casting of the type shown with the heavy flanges will take metal into the feeding heads for some time after it is poured if the feeder is kept open properly. Antimonial lead has a narrow range of fluidity and the feeding rod is absolutely useless since the feeding heads set so quickly. We believed that if we used feeding heads and churned them with a rod that we would be on the safe side. That method was not satisfactory. A cavity under each of the feeding heads proved that our theory was decidedly wrong.

Increase Flange Thickness

Lead castings are repaired easily by burning in. There is no danger of cracking as with gray iron, but the repair requires time and material. After observing the shrinkage in the first casting, we changed the method. Liquid shrinkage of antimonial lead is high and quick acting and must be met promptly. The better way to insure a solid flange is to carry the mold higher and have a shrink head the same size as the casting all around which can be cut off later in machining. The principle is employed in making large hydraulic cylinders and heavy rolls in gray iron practice.

Figs. 6 and 7 show the plan and cross-sectional view of the bottom head for the evaporator. This is identical with the top head except that it has a smaller nozzle opening on the bottom, 3 inches as compared to a 12 inch opening in the top head. We added 1-inch extra finish on the upper flange, making 2 inches of finish altogether as shown in the view of the bottom Fig. 7. When we added the additional finish we omitted all feeding heads from all the large castings and obtained solid flanges on the remainder of the heavy castings.

Figs. 8 and 9 show the plan and cross-sectional view of the heaviest casting, the manhole shell for the evaporator. In Fig. 8 it will be noted that six pouring gates each 1 x 4 inches, were used. The casting was much heavier than the top head and there was much more mold surface for the metal to flow over. The same size flow-off was used on all the large castings. It was large enough for the purpose. Fig. 9 shows the extra finish allowed on the top flange which eliminated the use of the feeding heads and produced sounder castings. The dimensions of the sight glass pads on the center line, not marked on the sketch, are 4 inches inside diameter and 8 inches outside diameter. It required 12,000 pounds of metal to pour the manhole shell. The rough casting weighed 9855 pounds.

The tube shell shown in Figs. 10 and 11 is similar to the manhole shell except that it is 10 inches less in depth. The same methods were used in making it as employed in making the manhole shell. The tube shell weighed 8640 pounds.

Fig. 12 is a diagrammatic view of the methods used in molding the manhole shell and the tube shell as shown in Figs. 8 9, 10 and 11. A cast iron plate 2 inches thick was set on top of the binders and about 4 or 5 inches of molding sand rammed on top of the plate. Straight edges were set, a level bed struck off, and when the bottom part of the mold was dried with a gas flame around the outer edge where the flange of the casting shows, the center core A as shown with the lifting plate in place was set in the center of the mold.

Thickness strips 1¼ x 1¼ inches, as shown at *B-B*, with a ⅜-inch hole near the top to draw them out, were set in place against the center core and the dry sand cores *C C* in 8 sections, 4 for the lower half of the mold, and 4 for the upper half, which formed the outside of the mold, were set against the strips as shown. When the cores were in their proper place the joints were mudded up on the outside to prevent the metal from straining into the sand that was rammed against the outside of the cores in the pit. As it is more than 6 feet from the top of the runner box to the bottom of the mold there is an immense strain against the cores in the lower half of the mold. Extra precautions must be taken to prevent this strain from producing a casting much thicker than needed.

Heavy iron plates were placed against the cores and well braced to the sides of the pit. Vents from the cores were connected to the floor line. To insure keeping the cores in the proper position the thickness strips were not withdrawn until the pit was rammed even with the floor. When the pit was dug for the manhole shell and the tube shell, it was made deep enough so that when the mold was covered with the top cover cores it would be about even with the top of the floor. The cope was not rammed until all the cores were set. The center core and cover cores were wedged firmly to the bars of the cope, the top binders set in place and bolted. When the runner was made as described earlier and the flow-off made, the mold was ready.

The casting for the tester, with cover attached shown in Fig. 13, was made with a split pattern. It was of such light section, weighing but 23 pounds, no extra finish was allowed for shrinkage. The only difficulty experienced in making the tester was in removing the unusually thin jacket core 3 inches in diameter, and but ¼-inch thick which does not allow much space for vents or wires to support the core. As antimonial lead is soft it cannot be tumbled, nor can it be sandblasted. We soaked the tester in the water tank for 20 hours thinking that would loosen the sand, and it did help some. We clamped the casting in a wooden frame and bumped it on a jar ram molding machine to loosen the sand, but we finally had to make a small tool, something like a dentist uses, and pick the core out in small pieces. Castings like the tester should be poured on end from the bottom upward so the metal will fill the mold evenly all around without danger of breaking the fragile jacket core.

Gated on the Flange

The body casting, shown in Fig. 14, was made from a split pattern and poured horizontally. Each of the 3 flanges had a shrinkage pad on the cope side one quarter of the diameter of the flange. The shrinkage pads and the method of gating the body casting is shown in the illustration. By using the shrinkage pads, feeding heads were unnecessary. A small pop gate, about ¾-inch in diameter, on top of each flange let the air out of the mold. The excess metal of the shrinkage pads can be melted off quickly with a cutting torch. The body casting weighed 1064 pounds.

Many years ago in a ship-yard foundry we witnessed an unsuccessful attempt to melt lead in a cupola to pour a 15-ton keel. The cupola was made up in the usual manner as for iron but the serious mistake was made of closing the tap-hole. Before the tap-hole could be opened the lead strained through the sand bottom and flowed over the foundry floor. Antimonial lead may be melted successfully in a cupola but a large deep bowl should be made in the cupola instead of a flat bottom, the tap-hole left open and but a few ounces of blast used.

We did not wish to risk melting the metal in the cupola for two reasons: (1) The antimonial lead might possibly pick up some impurities from the fuel or the lining. (2) Subsequent heats of gray iron might be contaminated. In melting the metal for the evaporator we

(*Concluded on page* 86)

ADVERTISING PAGES REMOVED

Gating Is Important Feature

(*Continued from page* 31)

suitably tagged. To prevent an accumulation of this material it is consumed in varying amounts from day to day. The compensating amount of metal for each day's operation is made up of ingot metal of known composition and physical properties.

Method of gating the castings is regarded as one of the most important factors in the production of clean, solid castings. This feature is not left to the individual judgment of the molders. All patterns are mounted on boards or plates and the pattern for forming the gate cavity in the sand is a definite part of the pattern equipment. In addition to insuring uniformity and adherence to supervisory control, this practice results in cleaner and firmer gates than could be produced by hand tools. Granting that a satisfactory gate can be cut by a highly skilled molder, the fact remains that highly skilled molders are not as numerous as formerly, and in addition the job occupies some time. The set gate saves time and also eliminates one of the potential hazards in the cycle of operations incident to the production of a mold.

Gates May Be Changed

Occasionally on new jobs the original gating method may be changed or modified slightly after the first casting has been examined critically, but as a general rule cumulative experience of many years enables the man in charge of the work to design a gating system that functions satisfactorily from the beginning. A few typical examples selected at random from a wide miscellany are shown in the accompanying illustrations.

On the comparatively heavy copper glands shown at the left in Fig. 2 the metal from the sprue passes first through a strainer core and then rises into the curved gate passage which leads to a large riser between the two castings. From the riser the metal flows through large openings into the mold cavities. Nonferrous foundrymen are familiar with the fact that copper shrinks more than other alloyed compositions in which it is one of the components. Also it is more viscid and the mass in a casting does not cool and settle uniformly. In foundry parlance the metal does not travel readily. Certain parts solidify individually and the result is either a porous area or an actual cavity between adjacent parts. These various tendencies are anticipated and prevented by placing the feeding riser as shown where the hottest metal direct from the gate enters the center of the casting last and fills the cavity which otherwise would be formed by solidifying metal pulling from each end. The large reservoir of hot fresh metal in the central riser is more efficacious than if the same volume was divided between two risers, one on top of each casting, and filled with metal partly cooled in the comparatively long journey from the sprue.

No Riser Needed

The heavily leaded bronze half bearing shown at the right of the same figure is gated in a different manner. The section of metal in this casting is fairly uniform, therefore it has not been necessary to place any riser either on top of the flange or elsewhere. Metal from the sprue at one side of the flask passes through a narrow runner which terminates at a second and larger sprue near the end of the casting. The metal enters the second sprue at a tangent which imparts a whirling action to the metal before it leaves the sprue and enters the mold cavity through a comparatively small gate. The centrifugal action of the metal holds any small particles of slag or dross in the center while the clean metal flows into the mold. This method of gating is highly favored and in various minor adaptations is applied to many of the castings.

This is illustrated in Fig. 3 showing several half bearings molded in green sand with green sand cores. The same type of pattern equipment is employed for molding whole bushings. Two half molds are made from the same pattern, one for the cope and one for the drag. The patterns are mounted symmetrically from center lines and the cope is turned end for end before it is placed on the drag. The size of the pattern determines whether it will be mounted singly or in pairs to suit the available flasks.

Fluidity of the metal, area to be covered and thickness of section exert an important influence on the size and position of the gate. Thus where a single small gate might conduct a free running metal into a comparatively large casting satisfactorily, a larger sprue and two or more gates might be required to conduct a smaller amount of dull, sluggish metal into a thinner casting.

In the mold for the half shell shown at *A* in Fig. 3, the metal from a central sprue falls into a horizontal runner extending from side to side immediately outside the core print. Relief risers at the ends catch any impurities floating in the metal before it enters the mold through two short gates. In the space between the center and the ends the runner is reduced in size to serve as a choke and thus maintain a head of metal in the sprue. The advantage of having a gate at each side is that when the two bodies of metal meet at the top of the core they are comparatively fresh and fluid and form a perfect union. If this casting was poured through a single large gate at one side, upward movement would cease temporarily while the metal was flowing down the hill on the far side. Any check in the movement of metal in a mold serves to develop a film, and every film is a potential source of a cold shut, a failure of certain parts of the casting to unite while in a molten condition.

An adaptation of the same principle is shown at *B* where one branch from the central sprue extends to the outer end of each casting, while a second branch carries metal to a central gate between the two castings. A combined dirt catcher and feeder is erected at the junction point. The gating arrangement on *C* is similar to that shown on the casting to the right in Fig. 2 and referred to previously. In contrast to the foregoing and illustrative of the point that many factors exert a bearing in the selection of a proper gate, the two bearings shown at *D* are each poured through a single gate at one end. Metal from a single sprue near one corner of the flask travels through a horizontal runner to a relief sprue where it attains a spinning motion through tangential entry and where any foreign material is collected and held. The clean metal flows into the molds through a small gate on either side.

Large Aluminum Casting

Peculiarities of design and varying thickness of metal in different parts of the same casting tax the ingenuity of the foundryman in producing large, intricate aluminum castings typified by the sample shown in Fig. 4. Part of the mold is made in green sand, but the entire interior and part of the exterior is formed in dry sand cores. Metal is poured through a single sprue shown at the upper right and enters the mold at a point between the cope and drag. Filling the mold with metal presents no particular problem. The problem is to manipulate the metal in the mold to prevent the formation of shrinks, draws, cracks and larger cavities. This has been accomplished by applying interior and exterior chills at strategic points and by the elaborate set of feeding risers as shown in the illustration.

The device shown in Fig. 5 marks the introduction of permanent molds

(*Concluded on page* 86)

Gray Cast Iron (*Chapter IV*)

(*Continued from page* 33)

The manganese content range of most commercial gray irons lies between 0.50 to 0.80 per cent and practically all are included by a specification of 0.40 to 1.00 per cent manganese. Within this range it is well established that manganese at first exerts a softening or graphitizing influence. This is due to the formation of manganese sulphide. As will be explained in a following section, sulphur uncombined with manganese has a powerful stabilizing action on the iron carbide. Manganese sulphide formation therefore prevents the sulphur from exerting its normal hardening influence. Manganese sulphide is composed of 55 parts manganese and 32 parts sulphur or about 1.7 parts manganese to 1 part sulphur. However, if the reaction in cast iron is to be complete an excess of manganese is required. Reasons for this are apparent to all who are familiar with the general concepts of the laws of mass action.

Determine Excess Required

Various investigators have attempted to determine the excess manganese content necessary. An investigation by Norbury, *Foundry Trade Journal*, Aug. 1, 1929, pages 79-83—indicates that within the ordinary range of sulphur content in commercial irons an excess of 0.30 per cent manganese above the theoretical requirement is sufficient to insure combination of practically all the sulphur with manganese. Spencer—*Transactions*, A.F.A.—1934—suggests that an excess of 0.35 per cent manganese is required. Since most commercial irons contain less than 0.12 per cent sulphur and manganese 0.50 per cent or above, this influence of manganese in ordinary gray iron practice usually is lost sight of. However, the importance of manganese sulphur ratio or balance is recognized by the manufacturers of chilled castings, such as rolls and car wheels, and by the malleable iron manufacturers. Gilmore — *Transactions* A.F.A., 1928, pages 287-292—states "Any excess sulphur present over manganese sulphide forms an iron sulphide and retains about 0.80 per cent carbon combined even after the most drastic anneal." Schwartz—*American Malleable Cast Iron*—refers to manganese and sulphur as opposing graphitization, and to the necessity for proper manganese-sulphur ratio. Spencer's work indicates that minimum chill is obtained when manganese percentage minus (1.7 x sulphur percentage) = 0.35. An excess either way increases tendency toward chill formation.

American blackheart malleable usually contains about 0.06 per cent or more sulphur and about 0.28 to 0.35 per cent manganese according to Bornstein.

In the manufacture of chilled rolls typical analyses cited by Shaw —*Transactions* A. F. A., 1926, page 820—show sulphur from 0.104 to 0.198 per cent, with manganese varying from 0.28 to 0.38 per cent. In this table the maximum difference between manganese and sulphur content is 0.27 per cent and the minimum, 0.11 per cent. The chill is due in part to the excess of sulphur.

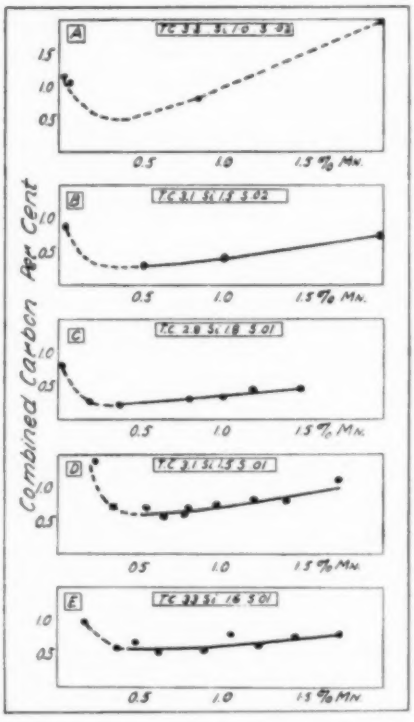

Fig. 67—Effect of manganese on combined carbon of gray iron bars. A, B, and C constructed from data published by Coe for 2 x 1-inch bars. Figs. D and E from data published by Wust for 1.2-inch bars

Specifications of the American Society for Testing Materials for chilled car wheel castings call for manganese 0.50 to 0.75 per cent and sulphur, 0.14 per cent or under. Manganese content must be three times sulphur content.

Manganese content in excess of that required for sulphur neutralization apparently tends to stabilize the carbide or to form complex iron-manganese carbides which are more stable than iron carbides. This effect is not very noticeable within the usual commercial range of manganese content in gray cast iron. Norbury has called attention to the necessity of carefully considering the influence of sulphur before proceeding to evaluate the direct action of manganese on cast iron structure.—*Foundry Trade Journal*, Aug. 1 1929. He emphasizes the effect of even small amount of sulphur in carbide stabilization and points out that in sufficient excess, manganese itself stabilizes the carbide, as in Fig. 67. A number of results from researches by Adamson, Coe, Dickinson and Shaw are cited. W. B. Parker—*Transactions* A.F.A., 1928, page 848—also holds that viewpoint. Hence, in presence of high manganese, the pearlitic carbide is stabilized in white irons of malleable composition. This is borne out by the statements of Evans and Peace—*Institute of British Foundrymen*, June 1928—and of Gilmore.

In ordinary gray irons with maximum sulphur content of 0.12 per cent and manganese usually 0.50 to 0.80 per cent it is obvious that small variations in manganese content will be without appreciable influence. There is good reason to believe that increase in manganese content to 1 per cent or somewhat above will have a strengthening and hardening influence, due both to carbide stabilization and to some alteration in the pearlitic structure. Cast steel manufacturers have taken advantage of that effect in the manufacture of the manganese alloy steels containing from 1.0 to 1.5 per cent manganese. Increase in strength and toughness are obtained with this manganese content.

Minimizes Necessity of Deoxidizer

The deoxidizing action of manganese has been referred to earlier, and its importance in this respect in steel metallurgy is well understod. Presence of a relatively high silicon and carbon in gray irons probably minimizes the necessity of using manganese as a deoxidizer. However, the author's experiments with cupola slags —The Foundry Sept. 1, 1931, pages 675-682—indicate that slags of proper composition, obtained in cupola melting of iron of 0.60 per cent manganese, have about 1.4 to 1.8 per cent manganese with 0.47 to 0.65 per cent sulphur. It is evident that a small but appreciable amount of manganese is removed as oxide.

F. J. Cook—*Transactions* A. F. A. 1931, pages 423-434—has called attention to certain inclusions which occur as glazy areas and which he attributes to a manganese-silicon content relationship. These areas, when occurring in pressure castings, evidently are zones of porosity and may cause decrease in wear resistance. It was found that when the silicon content is less than 0.4 per cent above the manganese content, occurrence of such areas is likely. The data pre-

(*Concluded on page* 86)

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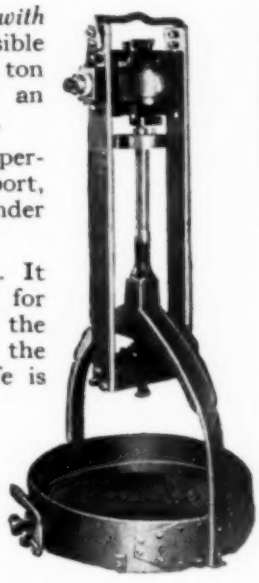

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Table II

Manganese Effect on Tensile Strength

	Total Carbon	Combined Carbon	Silicon	Manganese	Sulphur	Phos.	Pounds Transverse Strength Bar 12" x 1" x 1"	Deflection in Inches	Tensile Strength (Long Tons) per Sq. Inch
Coe	3.28	1.13	1.0	0.014	Trace	0.09	2732	0.094	12.67
Coe	3.15	0.82	1.02	0.846	Trace	0.09	3461	0.092	16.59
Coe	3.02	0.92	1.62	0.04	0.015	0.093	2665	0.132	10.16
Coe	3.04	0.43	1.50	1.03	0.015	0.093	3035	0.11	15.11
Coe	2.79	1.06	2.24	0.016	0.016	0.027	2240	0.08	9.92
Coe	3.03	0.69	2.42	1.96	0.016	0.027	3203	0.12	15.47
Hague and Turner	2.77	0.84	3.06	Trace	Trace	Trace	.....	.....	.....
Hague and Turner	2.62	0.22	3.00	0.50	Trace	Trace	.....	.....	.....
Hamasumi	2.90	0.82	1.65	0.15	0.02	0.01	.....	.....	16.8
Hamasumi	2.89	0.76	1.72	0.30	0.02	0.01	.....	.....	18.7
Hamasumi	2.96	0.86	1.61	0.69	0.02	0.01	.....	.....	19.9
Hamasumi	3.04	1.07	1.71	1.34	0.02	0.01	.....	.....	22.3
Hamasumi	2.84	0.77	1.85	3.94	0.02	0.01	.....	.....	26.3

(*Concluded from page* 84)

sented by Cook suggests that the inclusions consist largely of manganese silicate in the form of a slag.

The data of Hamasumi—presented by Shaw—*Transactions* A. F. A., 1928, page 299—are shown in Table II and indicate in a general way an increase in tensile strength coincidental with increase in manganese content.

In ordinary casting practice, the influence upon shrinkage of manganese within the usual composition range is not marked. Theoretically we would expect that the primary action, neutralization of sulphur influence, would decrease contracton and shrinkage and that increase in manganese beyond that point would result in increased shrinkage. This latter contention apparently is borne out by the statements of manufacturers of heavy castings.

The early work of Carpenter and Rugan—Journal Iron and Steel Institute, 1911, No. 1—indicates that an increase in manganese content of from 0.51 per cent to 1.60 per cent minimizes growth. This viewpoint is held by Campion, Levi, and others. It also is claimed that manganese helps in maintenance of strength at moderately high temperatures, although the author has seen no conclusive data in support of this viewpoint.

Gating Is Important

(*Concluded from page* 83)

for certain lines of castings. The machine shown was developed for the production of the type of brush holder shown mounted temporarily at three points on the machine. The casting is aluminum bronze showing a tensile strength of 75,000 pounds per square inch. The principal advantage of the machine is that it produces a casting of such extreme accuracy that no machining is necessary before it takes its place in a general assembly. Tolerance in the pockets and overall dimensions must not exceed 0.004-inch. The metal is poured at a temperature of 1150 degrees Cent. (2102 Fahr.). In the initial stage the mold is heated with a torch to a temperature of approximately 250 degrees Fahr. In operation the temperature rises to and is held at a temperature of 450 degrees Fahr.

Producing a Large Lead Casting

(*Concluded from page* 80)

knocked the lining out of our 5 ton ladle, put two re-inforcing bands on the ladle, welded all of the seams and around the rivet heads, sand-blasted the inside of the ladle and set it on heavy binders about 3 feet above the floor.

Core oven coke was used as fuel for melting the metal. With a long piece of pipe attached to an air hose under the bed of coke to furnish air to the fuel and increase combustion we did not have any trouble in melting. No flux of any kind was used to cover the metal. When the metal was melted we let it cool in the ladle and when the thermocouple pyrometer registered 650 degrees Fahr. we poured it.

Antimonial lead should be poured fast and large gates should be used. The metal will not stay hot long enough to blow as gray iron does, but wherever a light section joins a heavier one wrinkles frequently show on the surface of the mold which indicates that the mold should be filled quickly.

The most expensive operation connected with making antimonial lead castings is in removing them from the mold in which they are cast. Gray iron castings can be hooked by the top flange and lifted cores and all from the pit, but that cannot be done safely with antimonial lead castings. All the sand inside and outside must be removed before it is safe to lift the castings from the pit. In the manhole shell, for instance, shown in Figs. 8 and 9, the center core with the heavy lifting plate weighs something more than 4 tons with the extra amount of rods used for securing it properly. If we attempted to lift the manhole shell by the top flange without digging out the center core and removing the heavy cores from the outside of the mold the chances are we would pull the top flange away from the casting. The tensile strength of the metal is too low to permit handling the casting in that manner.

Great care also must be used in the cleaning room in handling the castings. When chains were used wooden pieces 1-inch thick were inserted under the points of the hooks otherwise the hooks would penetrate the casting. Rope slings were used to turn the castings over, and of course the same kind of care had to be used in handling the castings in the machine shop and in erecting.

Summing up the result in making the castings shown in the different illustrations, it appears to be definitely established that antimonial lead castings of almost unlimited size and weight may be made successfully if proper care is exercised. Several castings used on the apparatus are not shown as they are of no importance and did not need special treatment. Melting loss of the metal was approximately 3½ per cent.

Will Manufacture New Cut Off Machine

Tabor Mfg. Co., Philadelphia, has taken over the manufacture, sale and further development of the abrasive cut off machine developed by the West Co. Inc., Philadelphia, as described on page 76 of THE FOUNDRY for July. West Co. will continue to supply wheels for that machine and will co-operate with the Tabor Co. in the application of the equipment to the foundry industry.

ADVERTISING PAGES REMOVED

Simplify Foundry Accounting

(*Continued from page* 34)

can result in errors. The forms are standard throughout the company and certain details are required at some works but not at others.

A casting requisition in original hectograph is received with details as shown in Fig. 1. The *Alloy—P.D. Spec.* refers to the material, in this instance gray iron castings. The *Assigned Item* enables the receiving works to apply the casting to a specific order, and the *Deliver to* is the department to which the castings are to be delivered. Both these references are shown on the shipping report or delivery. The Cleveland foundry produces castings for other company works, as well as for the local factory.

Carries Up to Date Costs

Provided no changes have been made since previous run, repeat requisitions are completed in the production department by adding the production details as shown in Fig. 2. The figures shown in the *Rate* and *Total Cost* columns are not required for production purposes, and only appear on the permanent cost copy. Also, the entries made in the right hand portion of the form are not made in the production department, as explained later. The production file carries the up to date costs, and on local requisitions the *Standard Cost Each* is inserted, which obviates the necessity for another clerk referring to the file to cost deliveries.

Requisitions for castings not previously manufactured are accompanied or preceded by a pattern order. After a preview by the production department to determine when the pattern and corebox or boxes will be available this is referred to the time study department. It may be possible to establish the set-up and each piece allowances from formulas. If such is the case, the time study man inserts the allowances and places (+) in the *Pattern No.* space, which is the signal to duplicate copies for the time study and cost departments.

If the allowances cannot be checked from formulas, the (+) is inserted and the time study and cost departments' copies are referred to the time study man. When the job has been time studied, the allowances are established and recorded on all copies, and the cost copy is released. The allowances at Cleveland are for: Cores, molding, chip and grind (all cleaning operations) and finish. The other operation headings are not designed for this particular plant but, as previously explained, may be required at other points. Tumble and shot blast operations are included in the cleaning allowance as *Chip and Grind*.

The *Routing* is the group or section (Cost Center) performing the work and is the standard information for the production clerk, as well as for the time study man and cost clerk. The same casting will not be produced in any other manner until the standard files have been corrected by issuing a new set of cards.

Weight details are not available in advance of actual production. They are furnished by the shipper on the first run or when changes have been made. The (+) and the blank spaces are signals to the shipper to furnish the data. On repeat orders the weights are copied from the production file. The gross, gate or net weights (two of the three factors are necessary to calculate the metal cost) are inserted on the shipper's copy, which clears to the cost department via the production department. On multiple plate patterns, the weight per plate is furnished and reduced to *each* by the cost department.

Copies are distributed as follows: (1) Core dept.—pink (narrow); (2) S-Molder—blue (narrow); (3) S-Production—white (narrow); (4) Stock delivery—pink (narrow). (5) Special delivery—blue (narrow); (6) S-Shipper—blue; (7) S-Production—white; (8) Time study—white; (9) Cost—white; (10) Finishing—yellow.

S—Denotes standard copies required on *all* orders. The remaining copies vary with requirements.

No. 1 to the core department when cores are required, becomes the payroll detail upon completion of the order. If it is necessary to replace broken or scrapped cores, the foreman issues an order on a run off copy of the form, on which the details are inserted with pencil. Cost of these cores is charged direct to expense, as a quantity sufficient to complete the order already has been produced.

No. 2 goes to the molder for his own record of the quantity cast each day. The card is referred to the production department each morning for posting to copy No. 7, and later is returned to the molder. The molder is paid from the shipper's count reported on copy No. 6.

No. 3 is a production follow card.

No. 4 is for the shipper to record deliveries to stock and clears to the stock control division for entry. Partial deliveries are not recorded for value transfer as it is not essential to consider partials, except at inventory time.

No. 5 is for delivery of castings manufactured to customer's requirements, and is released to the cost department.

No. 6 is for the shipper who records all data for payroll purposes except core and finishing groups. Molding and cleaning groups are paid only for the quantity specified on the requisition and for *Company scrap*. The weight details not already available are inserted before the copy is released to the production department, and then to the payroll clerk.

Copy No. 7 is held by the production department to record the production details supplied by the molder and shipper.

Copy No. 8 is the permanent time study copy.

Copy No. 9 is the permanent cost copy.

Copy No. 10 is furnished to the grid finishing or the post finishing departments for payroll details.

In addition to the foregoing items it is necessary to furnish boxes for grids. A requisition copy for stock boxes, and manufacturing and delivery copies for manufactured boxes, are furnished the grid finishing department. Other exceptions may be made, with no particular effort, at the time the requisition is being duplicated.

Payroll details are compiled for the core group by accumulating the extended (allowed) hours in the calculating machine. An individual extension for each order is not made, but the accumulation for each day's completed orders is figured a second time as proof.

Payroll details for the molding and cleaning groups are compiled from the shipper's copy (No. 6). Due to numerous groups, a simple recap for accumulating the data is used. The extension feature is the same as for the core group. No cards are extended and recorded separately.

Disposes of Metal Loss

The recap, a form produced on the duplicator, furnishes the necessary data to dispose of metal loss on castings reported as *Molder Scrap*, and total loss (metal and labor) on castings reported as *Company Scrap*, for which the molder is paid. Allowed hour data by groups (cost centers) are available for expense and budget statements. All payroll and production essentials, in the molding and cleaning sections, are recorded on the recap. Payroll details for the finishing departments are similar to those in the core group.

The cost copy No. 9, is furnished only for new or changed patterns. The costing rate, which includes indirect manufacturing expense (overhead) and direct labor, in one factor, is inserted in the *Rate* column, and multiplied by the *each piece* allowance to arrive at *Total Cost*. The set-up allowance and an incentive bonus

factor are spread in the costing rate.

Metal cost is calculated from the gross metal poured with credit allowance for the return to the cupola of the gates and risers. The gross weight per casting is costed at the rate for metal at the spout, and the gate weight (credit) is costed at the rate for scrap metal. In this manner, light weight, large area, thin castings requiring an equal, or sometimes even a greater gate and riser weight, will carry a true metal cost. Heavy castings having a high percentage of net weight in relation to the metal poured will show a lower cost per pound of net weight, since a higher ratio of the cost of melting and cupola ingredients become production weight, and not scrap weight.

In addition to the internal details, which are handled with a minimum of writing, shipment of castings to other plants is recorded on a shipping memorandum in hectograph, from which the required copies for notification and value transfer are duplicated. A copy is used to accumulate the necessary weight information for other records which, of course, is supplemented by similar data for castings used by the local factory.

Wherever possible the forms are designed to incorporate not only originating department details, but also details added by other departments in the normal course of events.

Urges Stimulation Of Capital Purchases

Speaking at the Senate finance committee hearing recently on behalf of the Associated Business Papers, Inc.—a group of 127 of the nation's leading publications serving business men—L. C. Morrow urged favorable consideration of a proposed amendment to the revenue act of 1934 that would allow purchasers of capital goods the privilege of immediate amortization as a deduction from net income.

Much of the equipment in the mills, factories, stores and offices of the land is worn out, Mr. Morrow said and at least $18,000,000,000 of replacements are badly needed now. Only 35 per cent of the machine tool equipment now in use is up to date.

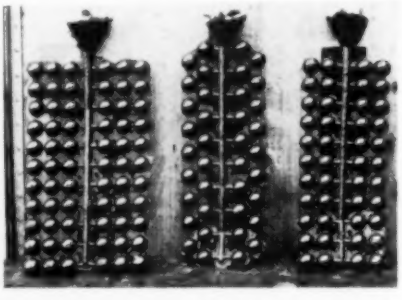
An army of 4,000,000 workers, who are normally employed by concerns that make capital goods—everything from typewriters to locomotives—continue to be out of normal employment. These workers can again earn wages, their employers can earn profits and pay taxes, Mr. Morrow said, if the pent up demand for these goods can be released.

To make such purchases, however badly needed they may be, business men need every possible encouragement. In Germany, wnere laws were enacted last year that allowed deductions from net income for purchases of corresponding types of goods, an immediate stimulation of demand was realized and much employment created. Since that time German producers of such goods have been exceedingly busy and most manufacturing establishments in that country have started to bring their production facilities up to date.

Since much of the normal investment in durable goods that is made by business is paid for out of profits, Mr. Morrow urged, that an inducement should be offered to utilize profits for much needed plant improvement. He said that such plant improvement was badly needed by the nation's industry not only for low cost production but to improve present facilities for national defense.

Two Grow Where Only One Grew Before

White iron grinding balls are used in immense quantities in the preparation of low grade copper ore for the smelters. In the foundry operated by a prominent western copper producer, these castings are poured vertically in a battery of cast iron molds. One half of each mold is stationary and the second



Evolution of the mold to secure greater production of castings

half is moved backward and forward by piston rods actuated hydraulically. After the castings have set the molds are opened and the castings fall on to a moving conveyor which discharges them into the tumbling mills where the action separates the castings from the gates and runners.

Evolution of a mold to secure greater production is shown in the accompanying illustration with 38 castings on the central sprue, 44 on the sprue to the right and 66 castings attached to the sprue on the left. An all steel scrap charge is melted in the cupola to produce hard iron for these castings.

The fourth international heating and ventilating exposition will be held in the International Amphitheatre, Chicago, Jan. 27-31, 1936.

Acquires Entire Interest in Company

A. G. J. Rapp has acquired the interest held by C. D. Hollins in Rapp & Hollins Inc. and will continue the business at the same address, 7001 North Clark street, Chicago. The name of the corporation has been changed to A. G. J. Rapp Inc.

Book Review

Cast Metals Handbook, 1935 edition, 521 pages, cloth, published by the American Foundrymen's association, Chicago, and supplied by THE FOUNDRY, Cleveland, for $4.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., London.

Publication of this volume fills a pressing need for the collection and dissemination of all available data on castings properties in one volume. The data presented represent the contribution of a large number of leaders in the four branches of the foundry industry, and therefore constitute the most recent and up to date information on the properties and applications of cast materials. The designing engineer and the engineering student will find the material contained in the Handbook of the greatest value. At the same time every foundryman should provide a copy for ready reference.

The first section on recommendations to designers of castings deals with the design of pattern equipment, points to be considered in casting designs, and the selection of alloys. Section 2 on recommendations to buyers of castings provides data required for intelligent estimation of casting costs and also recommendations as to the type of information which should be carried on inquiries from buyers.

The next four sections deal with the properties and applications of cast iron, malleable iron, steel and nonferrous metals and alloys. Data are included on physical properties, physical constants, properties at room, elevated and subnormal temperatures, ranges of chemical composition, specifications, metallurgy, testing methods and considerable other information. The text also deals with cast materials for heat, corrosion and wear resistance, including such data as room and high temperature physical properties, chemical compositions, service temperatures and the resistance of various alloys and materials to corrosive media.

The association and the many companies and individuals contributing to the material presented in the Handbook have performed a valuable service in furthering the possible applications of cast materials in every field. The volume is recommended highly to all who make or use castings.

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European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Iron Castability

Castability of Cast-Irons, (La Coulabilite des Fontes) by R. Berger. *La Fonderie Belge*, Liege, December, 1934.

Continuing the study of castability, the author has investigated effects of manganese for contents of 0.85, 1.15 and 1.45 per cent. The ternary system Fe-C-Mn first was studied, and curves plotted for carbon contents ranging from 4.6 to 2.75. It was found that in the regions investigated, manganese brought about no anomaly in castability.

Investigations then were pursued with the system Fe-C-Si-Mn within the following limits: Carbon from 3.50 to 2.75 per cent, silicon from 0 to 4 per cent, manganese from 0.20 to 1.50 per cent. Systematic tests were made with iron having certain definite silicon and manganese contents within the limits indicated, and the results of those tests were plotted and tabulated.

Similar tests were also conducted with iron containing silicon and phosphorus, to see the combined effect of these two constituents.

Having completed these investigations on the castability of cast-iron, the following conclusions were drawn:—

(1) The castability test is useful, both to the practical founder and to the research worker: it is accurate and easy of operation.

(2) As regards the study of cast-iron, a general law can be established: Eutectic compositions are those that have the best castability characteristics, and they are, therefore, the most susceptible to give the best castings. Hypoeutectic irons being the only ones used in practice, it can be said that the controlling element for castability is the carbon, followed by phosphorus, and upwards of 1 per cent by silicon; these three elements increase the castability. The action of manganese is of little importance.

(3) The castability test has given the explanation of the phenomenon of silicon anomalies, one of which remains the same irrespective of the concentration of foreign elements or of the nature of the iron, the other depending upon the variations of phosphorus and manganese, and showing its presence or not, according to the silicon content of the primary iron.

Growth in Irons

Heat-Resisting Cast Irons, (Les Fontes Resistant aux Temperatures Elevees) by Andre Dawans and Lucien Denoel. *La Fonderie Belge*, Liege, March-April, 1935. Extracted from "*Revue Universelle des Mines, de la Metallurgie et des Travaux Publics*", Nov. 1, 1934.

The phenomenon of growth resulting from alternative heating at high temperature and cooling is referred to in the introductory paragraphs. Growth, under those conditions, and its resulting effects are caused by graphitization; ruptures inside the casting, due to internal stresses; corrosion, which is due to oxidation, sulphur and silicates in the gases of combustion, steam and alkali.

The process of deterioration is explained by the fact that when the casting is heated above a certain temperature, the difference of expansion between the iron and the graphite causes minute cavities, which become oxidized; during cooling the iron contracts and the oxidized particles cause cracks in the direction of the graphite flakes. The repetition of this process finally causes complete deterioration of the casting.

A short chapter gives a summary of the various methods employed to investigate the corrosion of cast iron at high temperatures. This is followed by a brief review of the micrographic study of the corrosion of cast iron in an oxidizing atmosphere, and in industrial furnaces.

The possibility of neutralizing the factors of deterioration are discussed. To avoid graphitization there are means of stabilizing the carbides by additions or of obtaining stable irons containing only ferrite or austenite and graphite.

To avoid internal stresses the iron should have a low and constant coefficient of expansion and should be ductile at low temperature.

Against corrosion, various metals, such as nickel, chromium, etc., are added. The addition, in contact with the corroding medium, should form a protective coating, and added in sufficient quantity to be attacked by the corroding medium before the iron has had time to be attacked. A low graphite content, and an equal distribution of the graphite in small grains, will reduce the tendency of the various factors of deterioration to accumulate their effects by mutual reaction.

A chapter is devoted to a complete review of recent investigations made on heat-resisting cast iron by metallurgists of many countries. From the summarized results to date it is apparent that final conclusions on the effects of carbon, silicon and phosphorus content, and of various additions under varying circumstances, have not yet been reached. It seems agreed, however, that resistance to corrosion at high temperatures is obtained by the addition of aluminm, silicon or chromium: additions of titanium and magnesium also have a satisfactory influence.

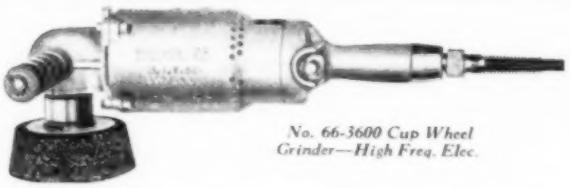
Soundness Factors

Some Factors which Influence Soundness in Nonferrous Castings, by Arthur Logan, *Foundry Trade Journal*, May 23 and May 30, 1935.

The many specifications for brass castings, one differing only slightly from another but resulting in added cost in extra care in the foundry, could be studied and reduced to advantage. Unsoundness in castings may result from a variety of causes, such as defects in sand, improper mold conditions, incorrect melting practice, pouring temperature, cooling rate, etc.

Numerous variables are controllable. After the design has been completed, the foundryman must decide on the way to mold the casting, arrangement, size and number of runners and feeding heads, and the casting temperature. The casting temperature normally fixes the rate of cooling, but to a slight degree the rate of cooling may be varied by chills to compensate for unequal sections.

The author has illustrated and described a number of castings in which difficulties were encountered, and in which satisfactory remedies were applied.



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Training Apprentices in England

(*Concluded from page 37*)

lection and training of all juvenile employes) co-operates closely with the local education authority, and also with the Ministry of Labor.

We require a probationary period of from 6 to 12 months, dependent on the starting age of the trainee, during which the particular trade the probationer wishes to follow is determined from eight available. During this period he and his parents are fully informed as to the nature of the training and the obligations of all parties toward the apprenticeship contract, which is recognized by an agreement drawn between the firm and the parents or guardians. The acceptance of the probationer as a trade apprentice is based upon supervisory reports of his progress in the works, and on examinations to determine further his general education and his physical fitness. Premiums have never been accepted by the company for any apprentice training course. On the contrary, the company has offered its apprentices a weekly rate of pay which, in the majority of cases, should go far towards their maintenance.

Skill Is More Important

Throughout the period of practical training the acquisition of skill is of more importance than the quantity of output. Skilled craftsmen are appointed as instructors—men who combine with their trade capacity a strong interest in apprentice training and who also possess marked teaching ability. These instructors cooperate with foremen in supervising apprentices. By way of examination, each apprentice is required every 6 months to turn out a piece of work needed in production.

The practical workshop training is graded so that the apprentice proceeds from the simpler to the more complicated practices. He is given some knowledge of trades allied to his own, and he spends a part of each day in the work school, where he is taught the scientific principles underlying the particular trade. Wages are paid for the time so spent. It has become traditional for the apprentice to attend evening classes in the local technical schools which abound in every town in the industrial districts. The company does not require such attendance, but apprentices who do attend are employed in departments in which they can apply their more advanced technical knowledge. The evening schools are regulated nationally as to courses provided, and graduates are awarded certificates.

During the period of apprenticeship the more able trainees are marked for promotion. Usually this takes the form of opportunities in the drawing office or testing departments, and from this stage the youth of ability will proceed through his advanced evening technical study to a staff position, from which point his upward progress depends upon his own energy and ability. As an incentitive the company awards each year 10 scholarships permitting part-time attendance at technical colleges.

In training for the professional side, it is customary for young men to continue their general education up to the age of about 18 years, when they will have reached the standard required for entrance to one of the universities having an applied science faculty. The university course lasts three or four years, then a period of two years of training is given in the works.

An alternative to this plan permits a youth to enter the works after attaining the degree of scholarship necessary for entrance to the university, and after one year of works training to take the university course, returning to the works for another year of training.

Candidates desiring admission to this course are required to make application in writing. Arrangements are made through professors of colleges for members of the company's apprentice selection group to pay a visit at least once a year, for a preliminary interview with prospective candidates. Those selected then visit the works and are interviewed by members of the "selection group" and conducted on a tour of the works. Final choice is made as a result of the visit, but candidates are not finally accepted until they have served for at least six months. At any time during this period probationers are at liberty to leave the service and, also, the company reserves the right to dismiss them. The time served during the trial period is credited as part of the regular course period. Candidates may become apprenticed to either mechanical or electrical engineering.

Manufacturing experience is given during the early stages of this course, followed by testing experience in the shops. It is not intended that the trainee shall earn his living as a craftsman, but it is the intention that the engineer must have practical training in works. Therefore the trainee works at the bench or machine tool, on the test beds, in the drawing office, in the foundry, doing exactly the same kind of work as is done by an apprentice who intends to become a craftsman. The only difference is the duration of the training, which is for a limited period only, the apprentice being moved progressively through the works so as to get a broad, general insight into every phase of manufacture, and in so doing to learn something of the workman's point of view, systems of organization, routing, production, and costing.

This experience gives opportunity for the development of inherent ability in one of the four broad divisions of employment, namely, works management, technical design, selling, or research. During the latter part of this training the apprentice is directed consciously toward one of these broad lines of work, and at the completion of his training he is posted to a junior position in the chosen field. At this point his real training begins.

Secure Practical Training

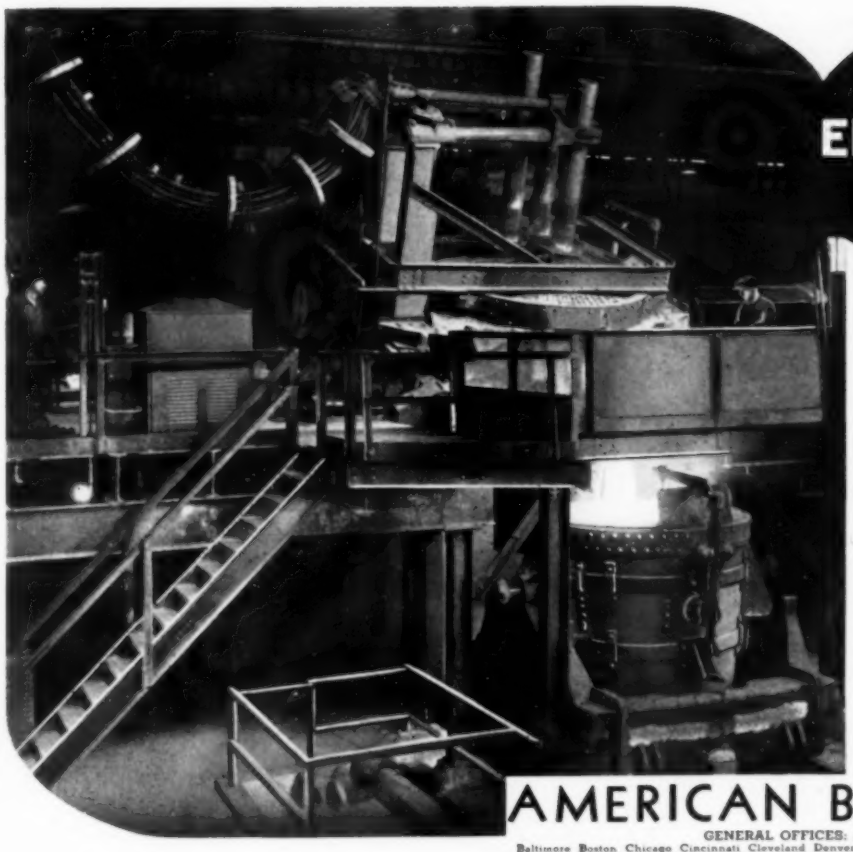
There is a further course for young people who lack the means to follow a university education but who can continue their general education up to, say, the age of 17 or 18 years. In many firms in the engineering industry, such young men are admitted to a course of practical training for a period of about four years, with the understanding that during this time they acquire the requisite technical instruction to enable them to follow a professional career by evening study.

In the large works, during his period of practical training, apprentices attend lectures and are given instruction by senior officers in various phases of industrial management. So far as possible each candidate is given jobs that test his capacity for undertaking responsibility, and at an early period a judgment is formed of his over-all capabilities.

There is an ever-increasing conviction among the leading industrialists that it is personnel which determines the success of a concern, and that no effort should be spared towards efficient training.

The problem of apprentice training for all industries and all levels of employment is one that cannot be left to chance to solve. It is, as in earlier days of industrial history, a vital factor, the importance of which becomes even more accentuated under modern economic conditions.

Standards for screw threads for bolts, nuts, machine screws and threaded parts, as approved by American Standards association, recently has been published by the sponsor organizations, the Society of Automotive Engineers and the American Society of Mechanical Engineers, 29 West Thirty-ninth street, New York.



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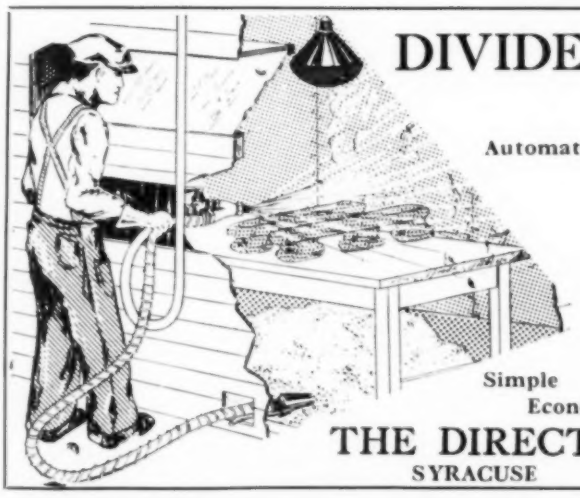

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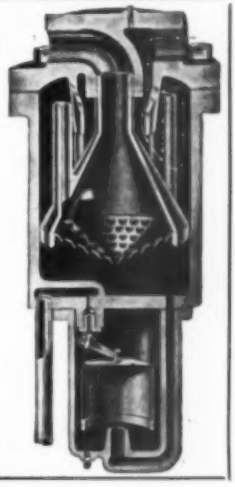

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(*Continued from page* 39)

sand extending from the inner arbor to the outside line of the ribs. At *B* the strickle *D* has been worked back and forth until the shoulders

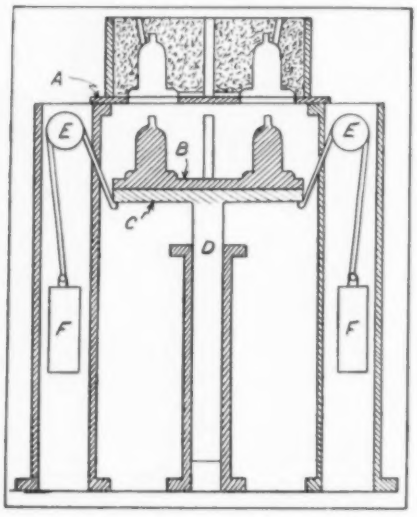

Fig. 7—Patterns for pipe balls are balanced by counterweights

rest on the ribs top and bottom. At *C* the sand line of the core is flush with the inside line of the ribs. A number of these strickles are required to fit the different size spaces between the upright ribs and the curved ribs on the top.

The pattern then is removed. The surface of the core is slicked with the tools and nailed, and afterward covered with a coating of silica wash. This is finely ground silica flour mixed with water containing a small amount of clay and molasses. The mold then is placed in the oven and dried, or in some instances surrounded by thin steel sheets and dried by a number of gas jets. The metal enters the mold at the bottom through two gates connected to the vertical sprue.

Allow for Contraction

Long anchor bolts extending from the bottom plate are attached to heavy steel beams resting on the edges of the pit. After the casting is poured the nuts are removed from these bolts and the outside part of the mold embracing the casting is lifted a short distance to prevent the casting from contracting too tightly on the core.

The second section of the foundry, as referred to previously, is devoted to the production of castings in a special type of iron developed by the Mackintosh-Hemphill Co. This is a pearlitic alloy iron which it is claimed possesses two or three times the strength of normal cast iron of equivalent section. It is also claimed that this iron possesses a uniform, homogeneous molecular and physical structure with nodular graphite. It is mass defect immune. The close grain persists throughout the casting irrespective of light or heavy section variations.

Among other claims is that castings are sound and homogeneous, free from porosity or spongy areas. It is made under accurately controlled chemical and physical conditions. Specifications rigidly are maintained. It is furnished in any hardness to meet definite conditions. Where the metal is poured in a chill mold it has a tough, hard face supported by a fine grained tough back. The metal is readily machinable in all grades except the chilled variety.

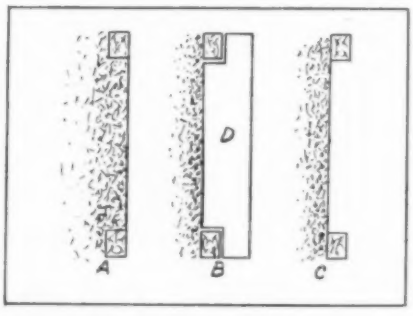

Fig. 8—Three stages illustrating use of sweep and skeleton pattern

The machined surface presents a clean fine grained appearance and takes a high polish. Tensile strength of the various grades ranges from 36,000 to 52,000 pounds per square inch. Any brinell reading may be secured between 150 and 490.

A large amount of this metal is poured into mill guides and piercing balls for pipe mills, two places where the service is unusually severe. A typical floor of pipe ball molds is shown in Fig. 6. These castings are made in a wide variety of sizes and are molded either singly or in groups of two, three, four or five. In this connection it is interesting to note that a type of small molding machine developed by the company, and a method of making the molds practiced for many years have proved exceptionally satisfactory. The method is simple and the Italian molders on the job have developed a high degree of skill and manual dexterity. Many of these men have been doing the same work for periods ranging from 10 to 30 years. Several young men started as building laborers while the plant was under construction and have remained with the company ever since in various capacities as semiskilled or skilled operators.

Belt Driven Machine

The type of molding machine differs from those usually encountered in the foundry in that several are belt driven from a line shaft. Each machine is equipped underneath with a short length of shaft, a cam, a clutch and a foot treadle. The operator fills the flask with sand and then steps on the treadle. This engages the clutch and a jolting action is imparted to the table of the machine. The combined flask, pattern and stripping plate then is lifted and placed upon the device shown briefly in outline in Fig. 7. The stripping plate *A* rests on the upright columns while the pattern plate *B* rests on the table *C* attached to the central plunger *D*. This table in turn is suspended by light wire cables which pass over the sheaves *E E* and terminate in the counter weights *F F*. Weights of table and counter-weights are nicely balanced and as a result the extra weight of the pattern plate is sufficient to depress the table as shown in the

(*Concluded on page* 99)

Fig. 9—One corner of the core room where small cores are made by hand

ADVERTISING PAGES REMOVED

(*Concluded from page 96*)

sketch. The mold is removed from the top, the pattern plate is lifted off and the counterweights pull the table C back to the original position flush with the tops of the columns. This description has been rather slow, but the actual operation only takes a few seconds.

After the mold is lifted from the pattern drawing device it is turned over and a second man in the crew of four, places one of the cores shown in Fig. 9 in each of the mold impressions. The base of the core closes the wide end of the mold and is provided with a small gate opening which coincides with the gate passage in the green sand leading to the central sprue. A third man places a shallow drag on the mold and then inverts the assembly and places it upon the floor. To increase the height of the sprue and risers, the fourth man in the crew makes shallow flat copes in a snap flask and places one on top of each mold. This feature may be noted in the molds shown in Fig. 6. In some instances the gate is a gap in the edge of the core base, while in others the gate is a small opening through the core base close to the main part of the core. All these castings are poured with the sharp points up. It is claimed that this method produces more satisfactory castings than where they are poured in the opposite position. A small skimmer core is set in a suitable print at the junction of the sprue and gates.

Cores for these castings are made from a mixture of 2 parts sharp sand and 1 part bank sand bonded with a dry binder. Cores are made by hand on a bench in small individual metal coreboxes. The coremaker fills the box with sand, raps it smartly on the bench several times, scrapes the top off flat, vents it with a wire, inverts it over a plate and removes the box. The loaded plates are taken away by an attendant and placed in a gas fired drawer type oven.

Changes Practice in Car Wheels

(*Concluded from page 36*)

graphitize part of the combined carbon — a job previously done by the pig iron — and establish a better strain-stress equilibrium. We might make good use of graphitizing agents, ferrosilicon, aluminum, copper, etc., but then it must be remembered that these agents are effective only in a narrow temperature range, and even there the derived results are not invariably uniform. At best the graphitization they produce is not fine, by comparison to temper carbon. In addition they increase the cost of the iron.

In our experiments we decided to make use of the well known principles of malleablization of white iron by resorting to higher annealing temperatures and in that we have been highly successful.

We started shaking out wheels soon after they reached the setting point. In that way our wheels reached the annealing pits when they registered a temperature at the hub of not less than 1800 degrees Fahr. In pits over 32 feet deep and stacking 28 wheels we soon accumulated enough heat in quantity and degree not only to equalize internal strains, but to accomplish the more important work of annealing, of changing part of the combined carbon to temper carbon.

The physical result of this procedure was a marked improvement in the appearance of the fracture of the wheels. The grain was finer and denser. The entire fracture outside the chilled iron part showed a velvety black color in contrast to the gray color the wheels had before. This velvety black fracture was progressively more apparent in wheels of higher tape, 5, 6, 7, etc.

Vary Chill Depth

A certain chill range on the test blocks ordinarily had its equivalent in wheels of tape 1, 2, 3, with a depth of chill from 1 to ¾-inch. Under the hotter and more effective annealing this same chill range produced wheels of tape 3, 4, 5 and 6 with a depth of chill ranging from ¾ to 7/16-inch.

The logical deduction was that our annealing was hot enough to change a certain portion of combined carbon into temper carbon similar to the malleablization of white iron, though not so pronounced. Furthermore, examination and comparison of fracture showed that this malleablization was done on a progressive scale beginning lightly at end of chill proper on the tread and ending heavier at the hub. The fracture itself had the characteristic black velvety color of malleablization.

Wheels thus malleablized even though made from an all scrap mixture with consistently higher sulphur and phosphorus — running at times to 0.20 per cent sulphur and 0.50 per cent phosphorus — showed a decidedly marked improvement in strength and tenacity under thermal and drop tests. As a matter of fact in the past 10 years we have had hundreds of test wheels stand 80 blows under the drop test and even more remarkable during the entire period we have had no thermal failure.

To sum up: A marked improvement has been effected in our chilled iron car wheels by using an iron mixture high in combined carbon, superheating the metal by melting on higher coke bed, annealing the wheels at a temperature of not less than 1550 degrees Fahr., and holding the wheels to that temperature at least for a few hours before they cool down gradually. We are strongly of the opinion that still better results can be obtained by superheating the iron to 2850 degrees Fahr., duplexing the metal to better control the total carbon to within the desired narrow range, and annealing the wheels at a temperature ranging from 1575 to 1625 degrees Fahr., depending on the total and combined carbon in the wheels. Artificial annealing may be necessary to secure the much desired even temperature throughout the pit and to at least partially malleablize the wheels.

We are confident the chilled car wheel industry is now at the cross roads of its future. Various types of steel wheels are becoming more and more formidable competitors. Modern trend in transportation is toward high speeds and lighter rolling stock which involve greater safety factors.

Traditional wearing advantage the chilled car wheel has had in the past over its competitors is not enough now. It must become lighter and stronger — in other words the wheel must slenderize — to hold its place in the scheme of modern transportation. As we see it, malleablization affords an excellent way to this goal.

Gray Iron Chapters Plan Greater Activity

A meeting of the Northern Illinois and Indiana chapters of the Gray Iron Founders' society was held in Chicago, July 26. Discussions were devoted to continuing and increasing chapter activities, according to H. M. Halsted Jr., executive vice president of the society, Cleveland. At a meeting of the Northern Ohio chapter of the Society, held in Cleveland, July 30, the following papers were presented: "Organization and Accomplishments of the Detroit Chapter of the Special Tool Die & Machine Shop Industry," by George E. Huebner, executive secretary of that industry, Cleveland; "Benefits to Be Derived Through Cost Comparisons," by A. C. Denison, president, Fulton Foundry & Machine Co., Cleveland; "Published Prices," by W. R. Beck, general sales manager of the Atlantic Foundry Co., Akron; "Value of Statistical Information to Members of the Chapter," by H. M. Halsted.

Discusses Bearings

Third edition of the Timken Engineering Journal recently issued by the Timken Roller Bearing Co., Canton, O., covers design of bearings, discussion of ratings, curves and factors which apply for speed, life expectancy, engine torque, use or application, etc.

Modern version of Garden of Eden

The Adventures of Bill

BY PAT DWYER

TAKING the situation by and large, as these nautical fellows say, I dare say the amount of stuff I have stolen, pinched, purloined, lifted, snagged or other wise converted to my own use in the course of a long and somewhat eventful life would not do my heirs much good if assembled and itemized in my last will and testament. Unfortunately none of the items is still in my possession, probably stolen in turn by divers and sundry low, light fingered gentry without morals or conscience, but as I say, even if I had them their value would not entitle them to a place in the will.

Obviously the list does not include boyhood spoils snatched from orchard and woodland at risk of life and limb. Quite properly I think the risk of a broken arm or the reception of a load of rock salt from an old muzzle loader a sufficient quid pro quo for the booty. The same reasoning holds with ancient forays on back yards for material for the annual Hallowe'en fire. Custom and tradition absolves one from any stigma of guilt in the matter of a few kisses here and there snatched at random under the witching light of the moon—or elsewhere. Also, if my memory serves me correctly on these far away and long ago incidents a tacit understanding prevailed among the boys and girls that the kisser stood ready at any time to return the - er - ah - purloined goods to the kissee. Under these conditions I doubt if the offense comes under any of the various branches of the legal code duly enacted for the benefit and well being of the commonwealth and the inhabitants thereof.

Legally, in the matter of stealing, my conscience is fairly clear. However, in the higher or spiritual sense where the desire to steal renders a person as culpable as if he actually pinched the object—Alas, how easily one falls into the underworld argot—I am afraid that I am entitled to a rather prominent position in any rogue's gallery. Lack of skill in the higher branches of stealing, rather than any moral scruples is all that has prevented me from acquiring many things on which I cast a covetous eye.

At present I am revolving several more or less ingenious plans for relieving Bill of an elegant knife he showed me the other day. The principal stumbling block to all the plans is that if I come into possession of the knife, I should want to keep it on display. Naturally, among others, Bill would be sure to see it. Up to the present I have not been able to invent any explanation to carry away a situation of that kind. Rather an awkward spot if you know what I mean. Headlines in the papers *Caught with the Goods* and all that kind of thing. Too risky.

At this point the impatient reader probably is saying to himself, "Why all this fuss and hulabaloo about a knife? If the unfortunate creature wants a knife, what's to stop him from going into a hardware store and buying one? If the truth were known his people probably would not trust him with an edge tool of any kind. I've seen birds like him Always going round with two or three fingers tied up in a bloody rag."

Beyond the brief statement that there is not a jot or tittle of foundation for this base calumny I shall offer no further comment. The idea! Edge tools, indeed! Probably I was shaving with a broad blade razor when his father was having his hair cut with a pair of sheep shears. By way of a finishing touch I might add that in the commonly accepted sense, this knife of Bill's—soon I hope to be mine —is not an edged tool. The material is iron which of course will not take nor hold an edge. My desire to own the knife is based on the artistic appearance and historical association.

According to Bill the knife originally was a spike in the hull of the U. S. *brig* NIAGARA, one of Perry's vessels in the historic naval engagement off Sandusky on Lake Erie Sept. 10, 1813. An engagement through which the United States regained supremacy on the Great Lakes, and a prominent factor in the ensuing treaty of Ghent where the independence of the former American colonies was recognized.

One night recently while we sat on the veranda idly discussing some of the interesting features, men, and events encountered at the Toronto convention, Bill produced the knife and extended it on the palm of a horny hand for my closer inspection. Clearly

(*Continued on page* 102)

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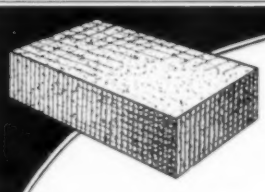

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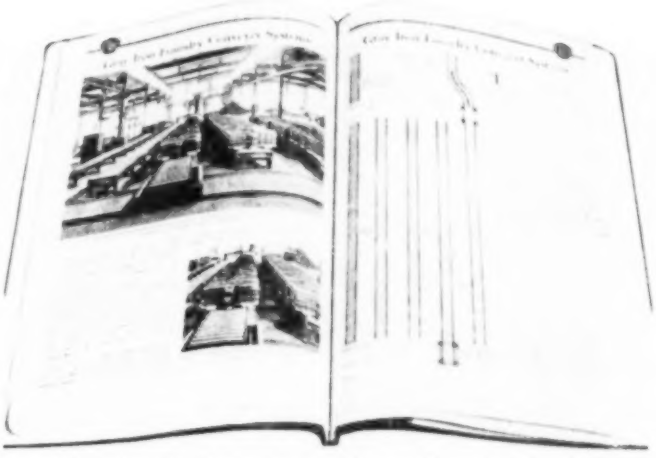

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(*Continued from page* 100)

this was the work of an artist and a master craftsman. The severely plain design enhanced by the contrast between the bright, shining blade and the rusty corroded handle aroused my cupidity before I learned of the other and more important features. Fearing that Bill would note the trembling fingers and the avaricious glint in the eyes, I remarked carelessly that it resembled a piece of junk. Might I ask where he had picked it up?

"What do you mean, picked it up?" Bill demanded indignantly "Let me tell you, young feller me lad, things like this are not picked up casually from the street or from black berry bushes by the wayside. What would you say if I were to tell you that this knife actually is unique in that you could not find a duplicate if you were to scrape these United States with a fine tooth comb from the well known Atlantic to the Pacific seaboard and from the equally well known Great Lakes to the Gulf of Mexico."

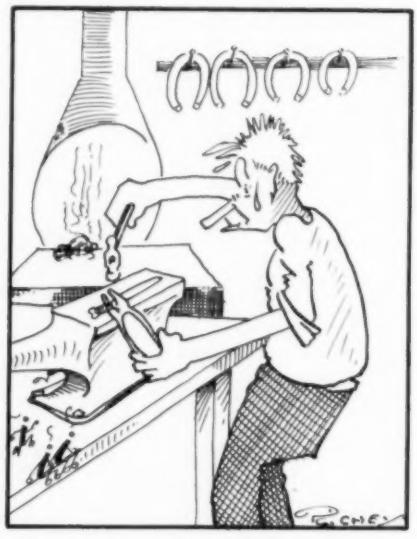
"Judging by the size and shape of the thing" I said "I should hardly expect to find one in any of these densely matted areas usually associated with the operation of a fine tooth comb. If I were searching for a duplicate to that weapon—as a matter of fact nothing could be farther from my mind at the moment—but as I say, if I were searching for a duplicate, I should make a tour of the hock shops. The material is not the same, but the general style and shape of the weapon is the same as the *skeane dhu*, the black knife inserted in the galligaskins slightly below the knee of every well dressed Highlander. In this weaponless land of the free and the home of the brave, it is conceivable that a transplanted Highlander having no further use for a lethal weapon might be moved cannily and thriftily to exchange it for a bit o' silver. Furthermore—"

"Furthermore and forbye" Bill interrupted in what he fondly imagined was the accent of the men of the moors and the moss hags "Ye might tramp the lang, lang road frae the Broomielaw to Tobermor-r-r-y, for the span o' a lang summer day, an' ye'd never see the fellow o' that dainty wee toy ye hold in ye'r hand! Man, I made it masel' ".

"So" I commented in an attempt at a feeble jest "you have added forging to your other activities. Bill the molder is now the Old Village Blacksmith in his Little Shoppee under the old chestnut tree. Horses, Mules, Donkeys shod with neatness and dispatch and in the latest mode".

Too late I realized that my enthusiasm had carried me out of my depth.

"Oky-dokie by me" Bill glanced casually at my feet "Come uppen see me s'm time, an' I'll fit a set of new shoes on you. Shoes with good, sharp calks in them to prevent you from slipping every time you attempt a small hill or a turn in the road. You remind me of a little black pacing mare, Peachy Carroll—Remember the old boy?—Peachy Carroll had one time. The different types of shoes he tried on that little vixen outnumbered the children of the famous old woman who lived in a shoe. Finally after he had pared the hoofs away almost to the ankles, or whatever you call that part of a horse's leg, he gave her up for a bad job. He sold her for $11 to a gypsy with one eye. The gypsy mounted her on roller skates, taught her a few tricks and exhibited her all over the country as Llallah Rooke, Star Equine Arabian Pi-fom-mah, now on the first Triumphal tour of Ah-mer-i-ca through special permission of her Own-ah, Ali Ba Dabah, Shawr of Per-shiah!"



Stance shows nice sense of balance

"It appears to me" I said "that if the one eyed gypsy had been endowed with normal vision he would have snapped you up instead of the pacer with the little short legs. He could have cleaned up handsomely exhibiting you as the Great Oom-pah, half Fish, half Chamois, Whistles through its Gills while Jumping merrily from one Conversational Point to Another. Stand back folks! He needs lots of air!

"Strange as it may seem I am not even slightly interested in little black pacing mares, one eyed gypsies or roller skates. If you can focus your attention on one subject for a few minutes, I should like to learn more about the knife. How and where it came into your possession and how do you know it is a genuine relic from the NIAGARA. Can't you stretch a point or two and claim that it came from the MAYFLOWER, Henry Hudson's HALF MOON or the FLYING DUTCHMAN? The NIAGARA only went down to the bottom of Lake Erie a little over 100 years ago".

"Well" said Bill "I'll tell you. In some instances extreme age is an important factor in appraising the value of an object, while in other instances the value actually may deteriorate with age. Wine bibbers who turn up their eyes in ecstasy over a goblet filled with the vintage of '79, will turn up their noses at food left over since the day before. Grandmother's old spinning wheel, or grandfather's flint lock musket is regarded with a certain degree of veneration and respect on account of age and family association. Conceivably under stress of necessity either or both might be sold to a stranger. Can you imagine any possible combination of circumstances or any price that would induce the mother of little Boy Blue to part with the little toy dog all covered with rust, possibly intrinsically worth two bits in its heyday when the little boy kissed it for the last time and said good bye?"

"All perfectly clear now" I hastened to assure him "This knife is dear to your heart and so forth because originally it was covered with rust and was kissed by Commodore Perry after he sent his famous message 'We have met the enemy and they are ours' ".

Any secret hope I may have had that this exhibition of heresy and flippancy would cause Bill to leave in a huff and forget to take his knife with him was doomed to disappointment.

"The trouble with you" he said "is that you have no imagination. If you had, you would be offering to buy the knife. On second thought, and knowing you as well as I do, you would be turning schemes over in your mind, crafty, underhand schemes for gaining possession of it without the formality of giving me anything in exchange. The piece of iron in itself has no intrinsic value, but it is a link with the life of a very gallant gentleman.

"Popular history, as usual has glorified the battle on Lake Erie, an event of a few hour's duration, but lightly skips over the herculean labor of six months involved in creating a fleet of nine vessels, in providing them with guns, ammunition and supplies and in recruiting and training a crew of 500 men. When Perry, the 28 year old naval officer arrived in Erie there wasn't enough shipbuilding material in the town to build a canoe. Inside of a month he had gangs in the woods felling the trees, and whipsawing them into planks. He had the fires going and the anvils ringing and he had a string of teams dragging bar iron and other supplies through the woods from Pittsburgh. By mid summer the tar pots were boiling, the calkers were driving oakum in the seams and the riggers were aloft bending the sails. Six months of feverish driving and incessant activity, where every nail and every spike was forged by hand and every square timber hewed with an adze culminated in a fleet which sailed out of Erie on a beautiful morning early in September and a few days later in a partly crippled condition limped back to port—with the enemy in tow.

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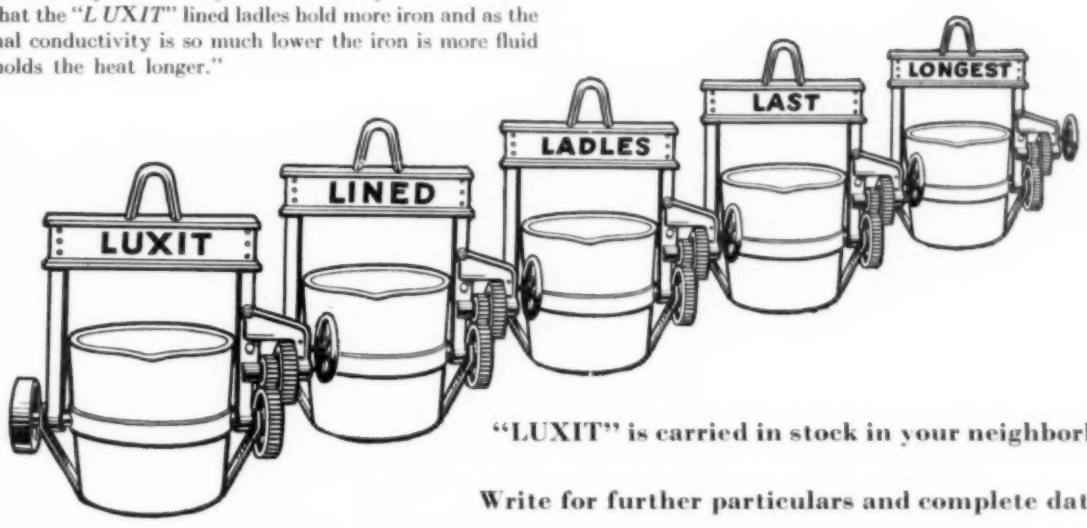

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Obituary

B. H. JOHNSON, assistant to the president, R. D. Wood Co., Philadelphia, and recently re-elected vice president of the American Foundrymen's association, died in Toronto, Aug. 27, aged 60 years. Funeral services were held in Swampscott, Mass., Aug. 29.

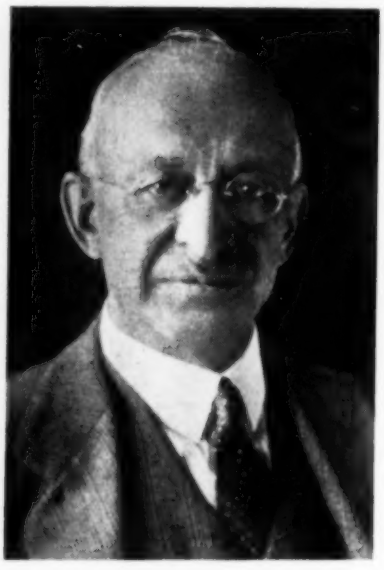
Mr. Johnson was born in Lynn, Mass. where he received his early education. His technical training was acquired at the Massachusetts Institute of Technology, Cambridge, Mass., and after graduation, he became associated with Taylor & Gooding, engineers and machinists at Lynn. When that firm was consolidated with the John T. Robinson Co., Hyde Park, Boston, Mr. Johnson accepted the position of superintendent. In 1910 he became connected with the Cresson-Morris Co. of Philadelphia as works manager and remained associated with that company for a period of over 15 years. He then became connected with R. D. Wood Co., first at the Florence Pipe & Foundry Co., Florence, N. J., and later in the Philadelphia office.

Mr. Johnson was identified with a group of Philadelphia foundrymen who in 1928 conceived the idea of establishing a trade association devoted to the gray iron jobbing foundry industry. In conference with foundry leaders in other localities, the groundwork was laid for such an organization and at a conference held March 13, 1928, at Pittsburgh Mr. Johnson as chairman of the Philadelphia committee was chosen to act as chairman of the conference. A meeting of gray iron foundrymen held during the American Foundrymen's association convention in Philadelphia during the week of May 14 also under his chairmanship resulted in the formation of the Gray Iron institute. Mr. Johnson was elected first vice president and later served for one year as president of the institute which under NRA became the Gray Iron Founders' society.

Mr. Johnson was an active member of the Philadelphia Foundrymen's association during his entire residence in that city. He took an active part in all technical and committee work and was a leader in the reorganization of the Philadelphia Foundrymen's association as the Philadelphia Metropolitan chapter of the American Foundrymen's association. In the A.F.A. he always was active on committee work, served for three years as a member of the board of directors and after an interval of one year was returned as vice president of the association during the convention in Philadelphia in Oct., 1934. He was re-elected to that position at the Toronto convention in 1935.

Mr. Johnson is survived by his widow, Mary Hadley Johnson, a daughter Kathryn, two sons, Daniel and Richard, all residents of Elkins Park, Philadelphia, and a sister who resides in Swampscott.

B. H. Johnson



Peter J. Krentz

Paul A. Ivy

• • •

Peter J. Krentz, 64, vice president, Buffalo Foundry & Machine Co., Buffalo, N. Y., died Aug. 16. Mr. Krentz, a native of Buffalo, started his career as an apprentice in the patternmaking trade with the George W. Trefts Co., at the age of 14. Several years later he organized the Model Pattern Co., selling it in 1905 to take charge of the pattern department of the Buffalo Foundry & Machine Co. He was advanced successively to the positions of superintendent of pattern and foundry department in 1906, works manager during the war and, in 1923 was promoted to the office of vice president. For years Mr. Krentz devoted himself to the designing of apparatus for the chemical and alkali trades and in developing special corrosion-resisting metals for such apparatus. An active member of the American Foundrymen's association, he was also a member of the Buffalo Engineering society. Mr. Krentz was elected a director of the American Foundrymen's association in which capacity he served for three years, his term ending in 1931. In 1923 he attended the first International Foundry Congress in Paris.

• • •

Paul A. Ivy, 55, vice president in charge of sales for National Cast Iron Pipe Co., Birmingham, Ala., died following an airplane accident near Gilmer, Tex., Aug. 15. He had been to Mexico City on a business trip and was on his way home when the accident occurred. He was general sales manager of the American Cast Iron Pipe Co. prior to going with National five years ago.

• • •

Walter S. Russel, founder, Russel Wheel & Foundry Co., and later the Russel Steel Construction Co., Detroit, died at his summer home in Belle River, Ont., Aug. 17. Mr. Russel was born in Detroit in 1855 and was graduated from the University of Michigan with a degree in civil engineering in 1875 and received a master's degree in 1880.

After spending five years in the shops of his father, who was one of the first manufacturers of railroad

(*Continued on page* 106)

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Promote Health — Reduce Costs — By Better Dust Removal

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Foundry - Proved Fluxes for Aluminum, Brass, Bronze, Iron, and Steel Foundries.

Foseco Products put higher physical properties, better appearance, lower production costs in your castings.

(*Concluded from page 104*)

cars and equipment in Detroit, Mr. Russel, with his brothers, George H. and John R., organized the Russel Wheel & Foundry Co. in 1880. The Russel Steel Construction Co. was a later expansion. Mr. Russel was a director of the American Radiator Co., Detroit Steel Products Co., Hoskins Mfg. Co., McCord Radiator & Mfg. Co., McCord Mfg. Co., and the Detroit Lubricating Co. He was vice president of the Detroit Engineering society and a past vice president of the American Society of Mechanical Engineers.

♦ ♦ ♦

Richard Bahmann, 74, former president, Blymer Iron Works Co., Cincinnati and the Cincinnati Bell Foundry Co., died in that city, Aug. 2.

♦ ♦ ♦

Leonard W. Whitmore, 66, president, Whitmore Machine & Foundry Co., and treasurer, International Wire Works, Menasha, Wis., died July 29. He was widely known in the paper mill machinery industry.

♦ ♦ ♦

A. Y. Dyer, metallurgist, Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., died Aug. 16. A specialist on uses of pig iron, Mr. Dyer formerly was connected with the Alabama By-Products Corp. and the National Cast Iron Pipe Co.

♦ ♦ ♦

Willard S. Beck, 53, assistant comptroller, United States Pipe & Foundry Co., Burlington, N. J., died as a result of an accident in Delaware City, Del., July 28. Mr. Beck had been in the employ of the company for 30 years, having started as a clerk.

♦ ♦ ♦

Oscar J. Shafer, 78, president, O. J. Shafer Pattern Works, Cincinnati, which he founded in 1883, died Aug. 1. Mr. Shafer was a life long resident of Cincinnati and was the oldest pattern manufacturer in the city. He was a pioneer member of the Cincinnati branch, National Metal Trades association.

♦ ♦ ♦

Louis C. Dietzer, '75, manager of pattern department, Gould Coupler Co., Buffalo, died July 30 after a brief illness. Mr. Dietzer was born in Buffalo and received his education in the schools of that city. A few years after his graduation from high school he entered the pattern business, serving as head of the pattern department, Jewett Stove Co. After being associated with that firm for 15 years he became superintendent, pattern department, Buffalo Scale Co., serving in that capacity for 16 years. He then entered the service of the Gould Coupler Co. where he remained until his retirement a year ago.

♦ ♦ ♦

Harry E. Stitt, 58, chief engineer, Austin Co., Cleveland, died Aug. 23. Mr. Stitt was born in Blairsville, Pa. and graduated from Pennsylvania State college with a degree in civil engineering in 1903. He was then employed successively by Heyl & Patterson and Jones & Laughlin Steel Co., Pittsburgh; Carnegie Steel Co., Youngstown, O.; and Arthur G. McKee Co. and Anton Burchard, Cleveland. He became connected with the Austin Co. in 1914 in the capacity of chief engineer.

Book Review

A Manual of Engineering Drawing, by Thomas E. French, cloth, 481 pages, published by the McGraw-Hill Book Co. Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $3, plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

The fifth edition of this widely used text in engineering drawing designed particularly for students and draftsmen, has been thoroughly revised to correspond to modern engineering practices. Both text and illustrations conform to the new standards for drawing and drafting room practice just completed by the American Standards association. Numerous illustrations have been added, the total now exceeding 800.

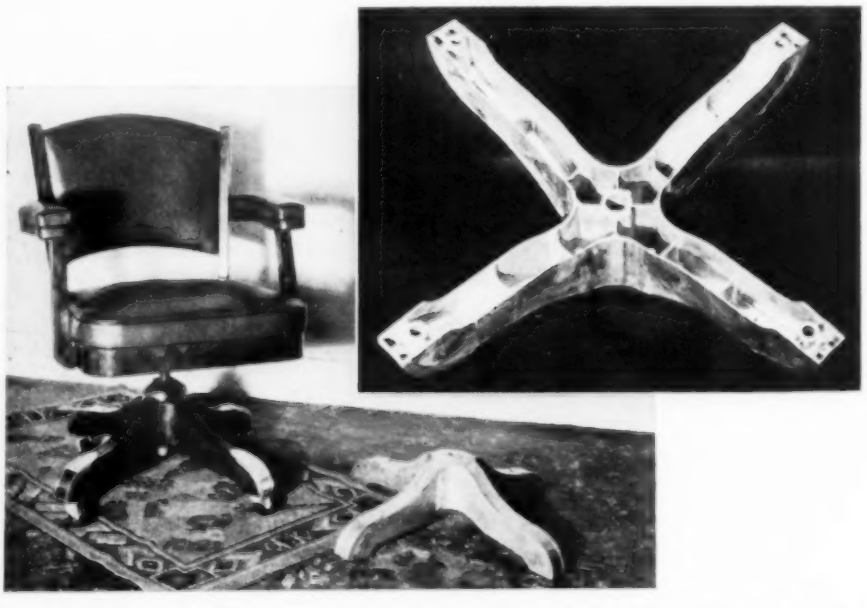
The first portion of the book deals with the instruments and materials needed in the drafting room. This is followed by a chapter on lettering and in which detailed methods are presented. This is followed by chapters on applied geometry, the theory of projection drawing, orthographic projection, sections and convention, dimensions and notes, bolts, screws, rivets and pipe, working drawings, and technical sketchings. Information also is presented on pictorial representation and perspective drawings.

The work consists essentially of a series of problems. In this edition, the favorite problems of previous editions have ben retained and more than 100 new ones added all representing current design. The work should be a most valuable text to the student in mechanical drawing, or the draftsman and engineer as a reference.

Exhibit Castings At Machine Tool Show

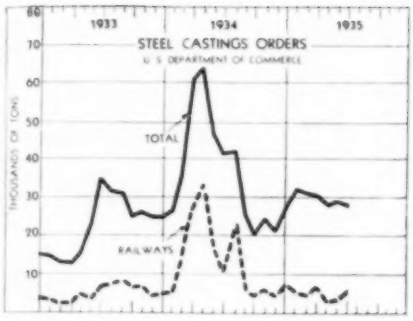
Two foundry firms are occupying space at the third national Machine Tool Exposition in Cleveland public auditorium, Sept. 11 to 21. These firms, Fulton Foundry & Machine Co. Inc. and Lake City Malleable Co., both of Cleveland are exhibiting castings. The former firm manufactures gray iron and Meehanite castings, while the Lake City firm makes a wide variety of malleable iron specialties and jobbing castings.

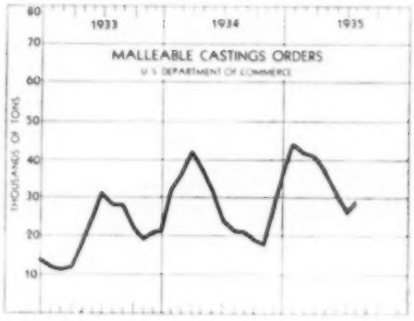
The Lake City Malleable Co. has exhibited at various industrial shows, purchasing agent conventions and other expositions and has accumulated an interesting display showing uses, factors in design and conversion to castings from other types of products, as well as photographs, models and actual examples of patterns cores and castings at various stages to show steps in manufacture. It maintains a permanent display section in the plant office.



Spider Base for a swivel chair made by the Doehler Die Casting Co., Toledo, O., from a silicon-aluminum alloy

ADVERTISING PAGES REMOVED





Foundry Activities

Reflect Industrial Trends

CONSTRUCTION is under way on a new plant for the Magnus Co. Inc. in Los Angeles, Calif., which is claimed to be the largest nonferrous brass foundry in the West, according to F. R. Nagel, resident manager. The new plant, containing 42,000 square feet and representing an investment in site, buildings and equipment approaching $150,000, will have a capacity of 1,000,000 pounds of brass castings a month. The structure is being built by the Austin Co. and operations are expected to begin about Nov. 1.

* * *

Pattern works and foundry of Vincent Schnorberger, Monroe, Mich., recently sustained damage by fire.

* * *

Plant of the Damascus Bronze Co., 928 Shore avenue, Pittsburgh,, recently sustained damages by fire.

* * *

Plant of the Glendale Foundry & Mfg. Co., Glendale, Calif., sustained considerable damage due to fire recently.

* * *

Louden Machinery Co., Fairfield, Iowa, manufacturer of equipment, is planning to rebuild its factory which was damaged by a tornado.

* * *

Central Foundry Co., Tulsa, Okla., manufacturer of iron castings, is erecting a new plant, 52 x 84 feet, at Lewis avenue and Frisco railroad.

* * *

Index of foundry equipment orders for July, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 93.3 as compared with 100.1 for June and 50.7 for July, 1934. Index of shipments was 102.3 as compared with 82.2 in June and 67.2 in July, 1934.

* * *

Officials of the C. & G. Foundry & Pattern Works, Indianapolis, Ind., have reported a business increase almost equivalent to pre-depression years.

* * *

Gray iron division, Benton Harbor Malleable Industries, Benton Harbor, Mich., recently suffered damage by fire to its foundry, including patterns and equipment.

* * *

Plant of the United States Cast Iron Pipe & Foundry Co., Scottdale, Pa., is being dismantled. The plant has not been operated for a number of years.

* * *

American Brake Shoe & Foundry Co., 230 Park avenue, New York, has given a contract to the Austin Co., Cleveland, for a research laboratory at Mahwah, N. J.

* * *

Gisholt Machine Co., Madison, Wis., has started construction on an addition to its factory to be used for a boiler room at an estimated cost of about $25,000.

* * *

Lennox Furnace Co., Marshalltown, Iowa, has been awarded a contract for 2000 heaters to be shipped to 12 different army posts for heating barracks for C.C.C. camps.

* * *

Wilson Foundry & Machine Co., Pontiac, Mich., was scheduled to reopen its plant immediately following Labor Day. Approximately 300 men were to be given employment.

* * *

Sullivan Foundry Inc., Sullivan, Ind., has secured patterns for heating stoves, ranges and furnaces, and will begin the manufacture of stoves at once. The firm, however, will continue to do foundry jobbing work.

* * *

Oscar W. Hedstrom Pattern Works, Chicago, has purchased a one-story modern brick building, 100 x 125 feet, located at 4836-42 West Division street. Operations at this new location are expected to begin about Oct. 1.

* * *

Production of iron and steel castings increased during July in the Philadelphia federal reserve district,

RAW MATERIAL PRICES
Aug. 4, 1935

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.00 to $ 5.10
Wise county beehive coke	4.30 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$13.00 to $14.00
Heavy melting steel, Pitts.(dlv)	13.00 to 13.50
Heavy melting steel, Chicago	12.25 to 12.75
Stove plate, Buffalo	10.25 to 10.75
Stove plate, Chicago	8.00 to 8.50
No. 1 cast, New York	7.00 to 7.25
No. 1 cast, mchy., Chicago	11.00 to 11.50
No. 1 cast, Pittsburgh	14.00 to 14.50
No. 1 cast, Philadelphia	12.00
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	13.00 to 13.50
Car wheels, iron, Chicago	12.50 to 13.00
Railroad malleable, Chicago	14.50 to 15.00
Malleable, Buffalo	13.25 to 13.75
Nonferrous Metals	
	Cents per pound
Castings copper, refinery	8.00
Straits tin	48.50
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary, standard)	16.50 to 16.75
Lead, New York	4.35
Antimony, New York	13.00
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.60

according to reports received by the industrial research department, University of Pennsylvania. Gray iron foundry activity increased to the highest level since April, 1931. Output of gray iron castings during July was 12.5 per cent more than in the previous month and 33.8 per cent more than in the same month a year ago. Production of malleable iron castings during July was 26.6 per cent more than in the previous month and more than twice as large as that for July, 1934.

* * *

Monroe Steel Castings Co., Monroe, Mich., has added a building, 30 x 130 feet, to its finishing department to facilitate handling of castings in that department. A new sandblast and double dust collecting system also have been installed in the plant.

* * *

International Harvester Co., Chicago, will double plant capacity by an addition to its main manufacturing building, a new steel storage building and a new boiler house at its plant in East Moline, Ill. Cost of this expansion program is estimated at $1,000,000.

* * *

Electric Auto-Lite Co., Toledo, O., has acquired the Alemite Die Casting & Mfg. Co. with plants in Chicago and Woodstock, Ill., for expansion purposes. It has purchased also the Central Brass & Fixture Co., Springfield, O. The new companies will be managed from Toledo headquarters, according to Royce G. Martin, president.

New Trade Publications

BLASTING—Pangborn Corp., Hagerstown, Md., recently has published its catalog No. 200 devoted to its rotoblast cleaning unit. Text and illustrations discuss in some detail the construction of the rotoblast unit, the barrel, the method of applying the unit to the cleaning of billets and tubes, the use of the rotoblast table cleaning machine, etc.

VALVES—Parker Appliance Co., Cleveland, recently has published its bulletin No. 38 giving detailed information on design, size, etc., of its line of valves of various types.

GLASSWARE—Kimble Glass Co., Vineland, N. J., has published a catalog presenting and illustrating its line of graduated glassware for biological, chemical and metallurgical laboratories.

HANDLING — A recent folder of the Lewis-Shepard Co., 236 Walnut street, Watertown, Mass. contains numerous illustrations of new materials handling methods.

VIBRATING SCREENS — Information on its line of vibrating screens is described in a four-page pamphlet by the Universal Vibrating Screen Co., Racine, Wis.

EYE PROTECTIONS — A short description of methods of eye protection accompanies equipment illustrations in a publication of the Chicago Eye Shield Co., 2300 Warren boulevard, Chicago.

ROLLER BEARINGS — A manual of cageless tapered roller bearing engineering data recently published by the Tyson Roller Bearing Corp., Massillon, O., contains large page diagrams, etc.

PLATING — Photographs clarified by detailed drawings of the semi-automatic and full automatic plating equipment of Frederic B. Stevens, Inc. are set forth in a 19-page brochure with a silver trim.

POWER TRANSMISSION—Mechanical Power Engineering Associates, 370 Lexington, avenue, New York, recently has published "A Practical Analysis of Some Fundamentals of Industrial Power Transmission."

CAMERA — Folmer Graflex Corp., Rochester, N. Y., has published a bulletin on the inspectograph camera. Numerous applications for the camera are listed, including photographing of fractures in castings.

CONVEYORS — "How to Handle It" is the title of a colorful booklet recently issued by the Chain Belt Co., 1600 West Bruce street, Milwaukee, giving an indication of the extensive application of Rex chain and belt conveyors in industry.

SAFETY SIGNS — An adequate conception of the signs to warn workmen at points of danger, manufactured by the Mine Safety Appliances Co., Braddock, Thomas and Meade streets, Pittsburgh, may be gained from its four-page pamphlet in color.

WELDING — An illustrated 16-page booklet "Thermit Welding—Industry's Master Maintenance Tool" published by the Metal & Thermit Corp., 120 Broadway, New York, describes the aluminothermic process employed for more than 30 years in the welding of heavy sections of ferrous metals. Application to specific products with actual cost data in some cases is given.

RUBBER—E. I. Du Pont de Nemours & Co. Inc., Wilmington, Del., has published a small booklet on DuPrene—a synthetic rubber produced from coal and limestone. Varous industrial applications for that type of rubber are presented.

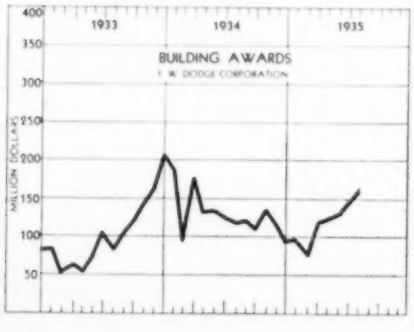
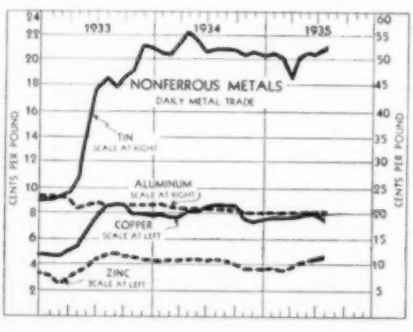
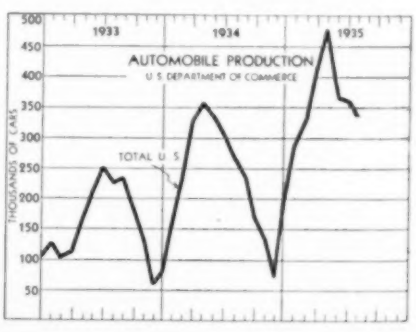
ANNIVERSARY — The twenty-fifth anniversary of the A. P. Green Fire Brick Co., Mexico, Mo., has occasioned the publication of an attractive silver and green brochure picturing old and new style methods of application, recreational activities of employes, and foreign distribution of products.

MICROSCOPE ACCESSORIES — A new 48-page booklet details microscopic equipment manufactured by the Bausch & Lomb Optical Co., Rochester, N. Y. An additional 14 pages are devoted to price list and magnification tables for microscope accessories.

DUST CONTROL — A method of solving foundry dust problems with the air curtain dust control system and the roto-clone dynamic precipitator is made especially understandable by labeled parts of the equipment and a diagram in a recent pamphlet of the American Air Filter Co. Inc., Louisville, Ky.

TRANSFORMERS—General Electric Co., Schenectady, N. Y., has published a recent bulletin on "Air-Cooled Transformers for Lighting and Power Service." The company also has prepared the publication "Cable Accessories" which describes joints, terminals, oil reservoirs and other accessories.

DUST FILTER — Uses, processes, construction, information needed for quoting on special requirements, and a table of dust filters manufactured by Ruemelin Mfg. Co., 386 North Palmer street, Milwaukee, comprise the subject matter of a recent four-page pamphlet of that company.

DRIVES — Any drive can be completely designed and the cost determined from the 48-page catalog on V-belt engineering published by the Gates Rubber Co., Denver. Effect of oil, water, steam, dust, and chemical fumes on V-belts and easy method of checking tensions are discussed.

CHAINS—Baldwin-Duckworth Chain Corp., Springfield, Mass., recently has issued a catalog on chains and sprockets for power transmission, conveying and elevating. The book describes the company's standard roller chains, parts and attachments, multiple chains, extended pin chains, noncorrosive chains, block chains, etc. A 20-page section is devoted to practical engineering data on chains.